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COMPUTER RECOVERY OF ACOUSTICAL PARAMETERS,(U)
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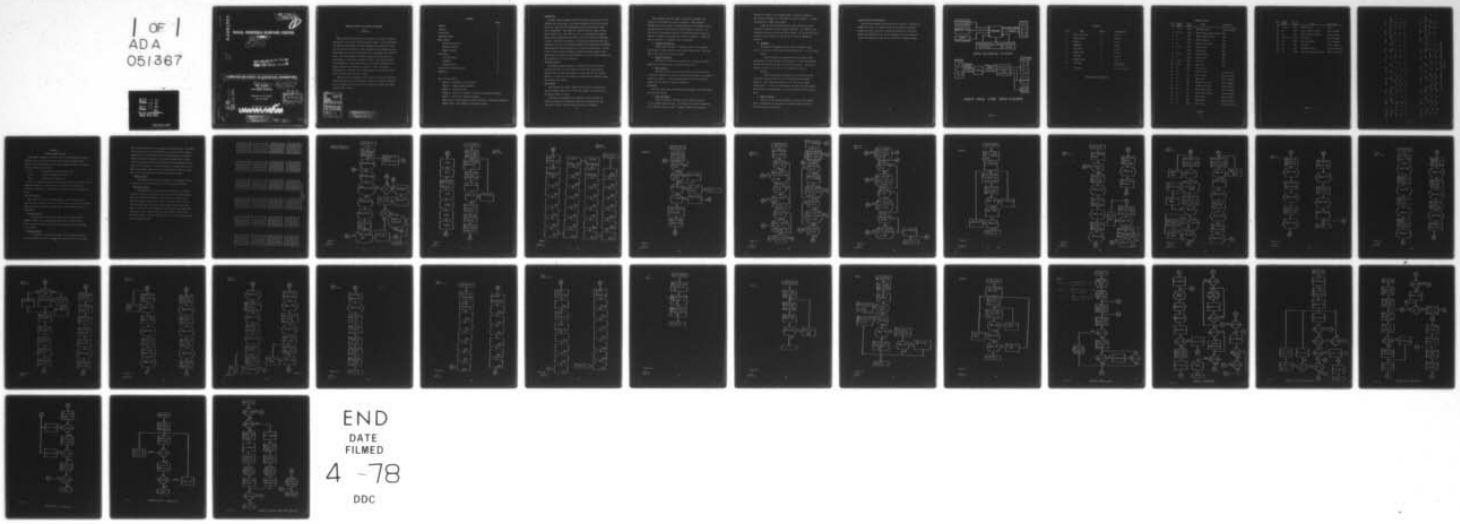

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(6) COMPUTER RECOVERY OF ACOUSTICAL PARAMETERS

(10) by C. B. Allen

San Diego, California

(16) S23Ø5

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COMPUTER RECOVERY OF ACOUSTICAL PARAMETERS

By
C. B. Allen

This technical note describes two separate, but related, computer programs for use with the CP 642B (USQ-20B) computer. The first program can transfer incoming data to computer magnetic tape data and/or test, convert, and print either data from a specialized data gathering system used aboard ship with both experimental and conventional sonar installations. The second program is written to process, search, and print specifically selected related segments of data. The selection/search is determined by 10 basic parameters--five equipment related and five target related, each having up to 7 options. Prior to printing, 6 bearings and 4 ranges must be averaged along with the status of data from 4 counters and 13 operator controls.

This note has been prepared in the interest of others at the Naval Undersea Warfare Center and represents a segment of a project concerned with the collection of at-sea data for underwater detection and target classification studies.

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INTRODUCTION

The Naval Undersea Warfare Center has designed and tested, with both simulated and real inputs, a real-time automatic data collection system that can be used with both experimental and fleet operational sonars (e.g., AN/SQS-23G). Data inputs are obtained from the ship's environmental sensors (e.g., gyro, EM log, etc.), the experimental equipment, ship's sonar, and miscellaneous inputs from both counters and thumbwheel switches. The data is recorded on a standard instrumentation type tape recorder by the use of the Automatic Digital Data Gathering System (ADDGS) while additional analog information is recorded simultaneously. The data is then recovered with the Computer Compatible Playback System (CCPS) using either the Univac CP 642B (USQ-20B) or the Control Data Corporation's 3200 computer as is shown in Figure 1.

AUXILIARY PROGRAM

The computer program contained in Appendix A can read data from the CCPS in blocks of 27,777 computer words (30 bit) onto computer magnetic tape for later processing, or it can print out the recorded data as it is read into the computer, provided that the original analog tape speed is not changed.

MAIN PROGRAM

This program (flow charts, Figures 6-27) transfers all data back into the computer one block at a time and examines it in blocketts of 18 computer words at a time.

Processing is accomplished by searching the data contained in continuous segments for parameters which are in agreement with the "parameter control" cards previously read into the computer.

These parameters and the number of options per parameter and location in the blockett are shown in Figure 2. After parameter agreements have been found, the remaining data in the blocketts will be accumulated until a discontinuity in any parameter is incurred. At this time, the accumulated data will be processed further as shown in column 5 of Figure 3 and printed out as shown in Figure 4. Search can then be continued or terminated as the user wishes.

1. Blockett Construction

Each blockett contains 17 computer words of 4 bit BCD data. The BCD data is right justified in the 30-bit computer word. The 18th word is all ones and is used as an index.

2. Number of Searches

The number of searches is controlled by a program card named CARDX with the number typed in column 21 and name in 11.

3. Type of Search

The name of the first parameter control card is DRC starting in column 11 and with the option in increasing item number as per Figure 2 starting in column 21. The remaining parameter control cards should contain only the options starting in column 21.

PROCESSING

The three major types of processing are averaging, list and changes, and total over period.

1. List and Changes

Items 13 through 21 of Figure 3 are 4 BCD bits; however, 7 is the maximum number allowed. If, therefore, during the processing of a continuous segment of data a change is made in any of these,

setting 10 is added to the original number. If item 17, Figure 3, were 3 and was changed to 2, the number 13 would be printed. A 3 would be printed if no change was incurred.

Items 24, 26, 27, and 28 are more than 4 bits and are first converted to binary for ease of computer handling. If a change occurs, an asterisk is printed out along with the number. If item 28 was 79 and changed to 58, the print-out would be 79*, or 79 if no change was incurred.

2. Averaging

Two types of averaging are used; linear information items (2, 3, 5, 10, and 11) and bearing information items (6, 7, 8, 9, and 23).

Linear

Linear averaging is accomplished by converting the BCD information to binary and summing each blockett. At the discontinuity, the sum is divided by the number of blocketts processed. The maximum number of blocketts is 30,000; no test is made for overflow.

Bearing

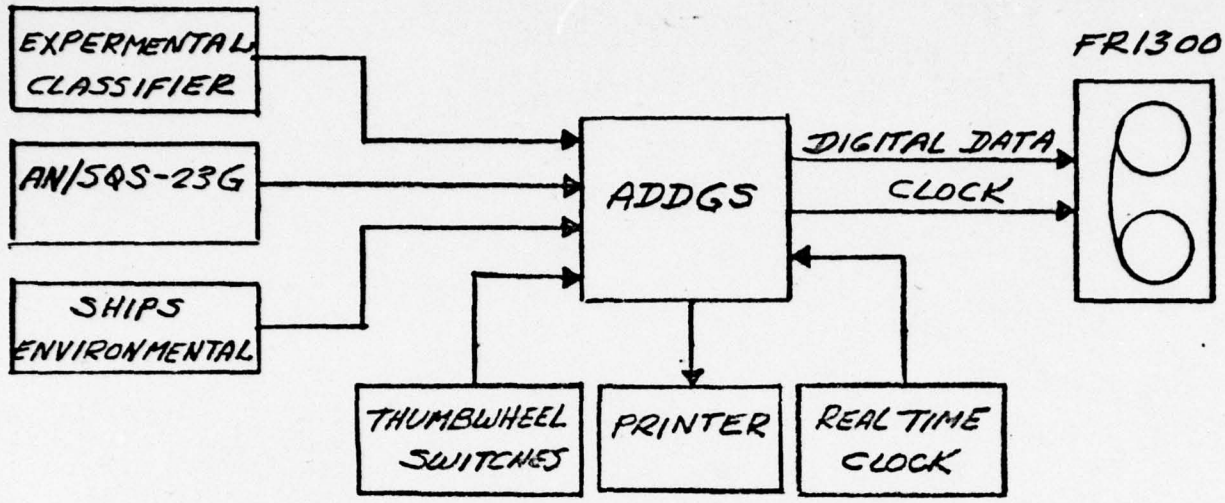
Bearing averaging is accomplished by converting the BCD information to binary and the use of a special subroutine THETA, Figure 26. This subroutine examines for the 360 and 000 degree discontinuity. It tests the incoming data with the first data sampled and adds them in a proper manner. No test is made on the sum for overflow.

3. Total on Period

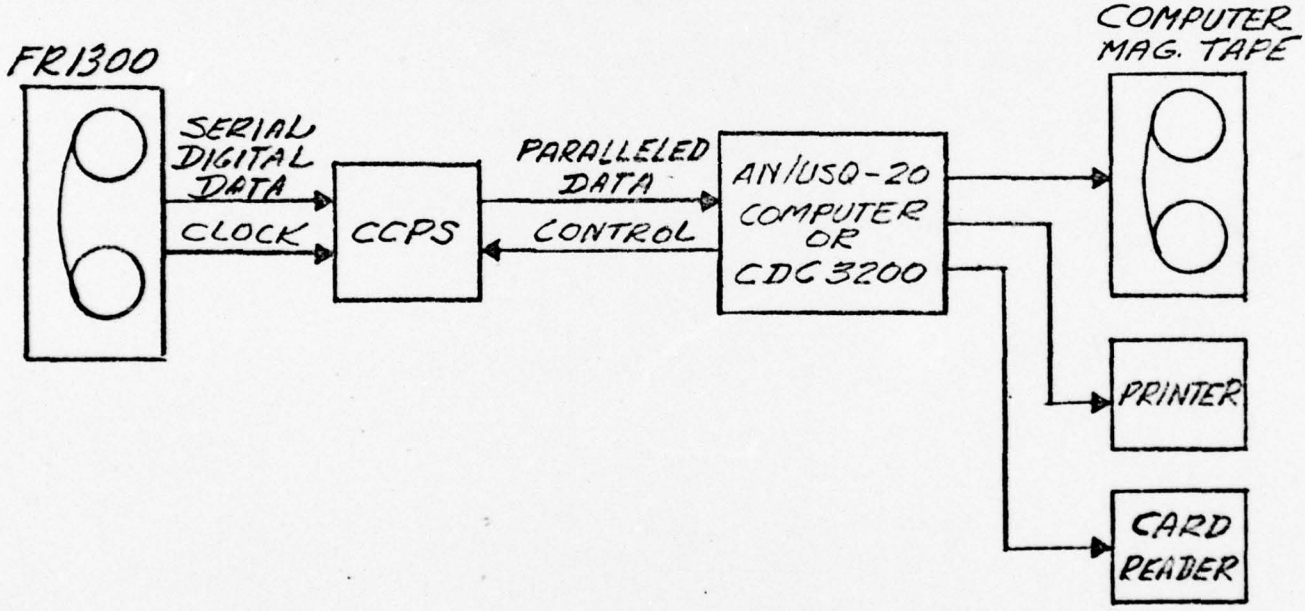
Items 1, 22, 29, and 30 of Figure 3 are total on the period. This is accomplished by subtracting the converted BCD of the first blockett from the last blockett.

CONCLUSIONS AND RECOMMENDATIONS

The auxiliary program was required as per contract to evaluate the ADDGS/CCPS system. The Computer Recovery of Acoustical Parameters program was written and used on simulated data prior to sea trials aboard USS SARSFIELD DD-837. It is recommended that the programs be refined and improvement made in the utilization of computer memory.



DATA RECORDING SYSTEM



NUWC REAL TIME DATA SYSTEM

FIGURE 1

FIGURE 2

Item	Name	Option	Word Location
1	AN/SQS-23 status	4	7 of 17
2	Aspect status	4	6 of 17
3	FM mode	4	5 of 9
4	Bandwidth	6	6 of 9
5	Time band	7	7 of 9
6	Target type	4	6 of 13
7	Sub type	4	5 of 13
8	Target aspect	4	3 of 12
9	Sub depth	3	6 & 7 of 14 1 & 2 of 15
10	Sub speed	3	7 of 15 & 1 of 16

COMPUTER SEARCH PARAMETERS

LOCATION OF DATA

Item	USQ-20 Words	No. of Bits	Data	Processing
1	1 & 2	(48)	Date Time Group	Total on period
2	2 & 3	(32)	Target Range (course & fine)	AVE
3	4	(12)	Ship's speed in knots	AVE
4	4	(16)	Target Bearing	AVE
5	5	(12)	Wind speed in knots	AVE
6	5 & 6	(16)	Ship's course	AVE
7	6	(16)	Ship's roll	AVE
8	6 & 7	(16)	Wind direction	AVE
9	7	(16)	Ship's pitch	AVE
10	7 & 8	(20)	FM range	AVE
11	8 & 9	(20)	Range rate	AVE
12	9	(8)	Calendar year	
13	10	(4)	Transmit Code	List & changes
14	10	(4)	Burst Length	List & changes
15	10	(4)	Range Rate	List & changes
16	10	(4)	Display Scope Scans	List & changes
17	10	(4)	Display Scope Gain	List & changes
18	10	(4)	Scope Scale Normal	List & changes
19	10	(4)	Scope Scale Expanded	List & changes
20	11	(4)	Test Signals	List & changes
21	11	(4)	System Check	List & changes
22	11	(20)	Ping Count	Total over period

Figure 3

Item	USQ-20 Words	No. of Bits	Data	Processing
23	11 & 12	(12)	Target Course	AVE
24	12	(12)	Misc. Recorder Reel #	List & changes
25	13	(12)	Layer Depth in Fathoms	AVE & changes
26	13 & 14	(12)	PME Reel #	List & changes
27	14	(12)	Run Type/Number	List & changes
28	16	(8)	Run Type	List & changes
29	16	(16)	PME Tape Footage	Total over period
30	17	(16)	Misc. Recorder Turns Count	Total over period

Figure 3

STAT-23L ASPT-1 FMM-S BW- 78 TW- 16 TT-DS ST-F IA-ST SD-0 SS-0

PMERL ZU	FT EIC	MSREL WH	TURNS BWY	RA CO	LAPD CT	H2O RN	PNCT RT	DMH DSS	RAFM DSG	DML SSN	KKK SSE	XTD TS	BLG SC	BYA TIME	DTG
111	0 111	0	11110	111	1111	0	11	11100	11	1	1	1	111	11 11	11
111	111	11	111	111	111	111	11	1	1	1	1	1	1	0	0 0
111	0 111	0	11110	111	1111	0	11	11100	11	1	1	1	111	11 11	11
111	111	11	111	111	111	111	11	1	1	1	1	1	1	0	0 0
111	0 111	0 -	0 -	0 -	0	0 -	0 -	0 -	0	1	1	1 -	0	11 11	11
- 0	- 0 -	0 -	0 -	0 -	0	111	11	1	1	1	1	1	1	0	0 0

11

STAT-23M ASPT-3 FMM-R BW- 156 TW- 32 TT-SS ST-G IA-BE SD-0 SS-0

PMERL ZU	FT EIC	MSREL WH	TURNS BWY	RA CO	LAPD CT	H2O RN	PNCT RT	DMH DSS	RAFM DSG	DML SSN	KKK SSE	XTD TS	BLG SC	BYA TIME	DTG
222	0 222	0	22220	222	2222	0	22	22200	22	2	2	2	222	22 22	22
222	222	22	222	222	222	222	22	2	2	2	2	2	2	0	0 0
222	0 222	0	22220	222	2222	0	22	22200	22	2	2	2	222	22 22	22
222	222	22	222	222	222	222	22	2	2	2	2	2	2	0	0 0

Print Out of Computer Recovery of Acoustical Parameters.

Figure 4

APPENDIX A

TAPE LOAD/TEST ROUTINE

This computer program was written to test the ADDGS/CCPS data system. When Key 1 is set, it can be used with the companion program of this report to load the digital data onto computer magnetic tape. The controls for this program are as follows:

Key 1	Write data on computer magnetic tape.
Key 2	Prints out magnetic tape data.
Key 3	Terminates all processing.

As it is a separate program, it may be used to test the validity of the companion program by the use of Key 2. An example of its output is contained in Figure 5. The total flow diagrams are shown in Figures 27 to 33.

EXECUTIVE ROUTINE

The executive routine is the main program. Its functions are to clear the input and print buffers, to test the keys, to call the subroutines Data Gen, Restack, Preprint, and Tape Write, and to control print out.

SUBROUTINES

Data Gen Routine

The Data Gen routine is to transfer data in blocketts from INBUFF or INBUFF B to a working table called LYN. It also tests if there is data in the input buffer while maintaining where it is working in the buffer.

Restack Routine

The function of the Restack Routine is to convert and transfer the 4-bit BCD data from the 17 computer work table LYN to a 6-bit, excess

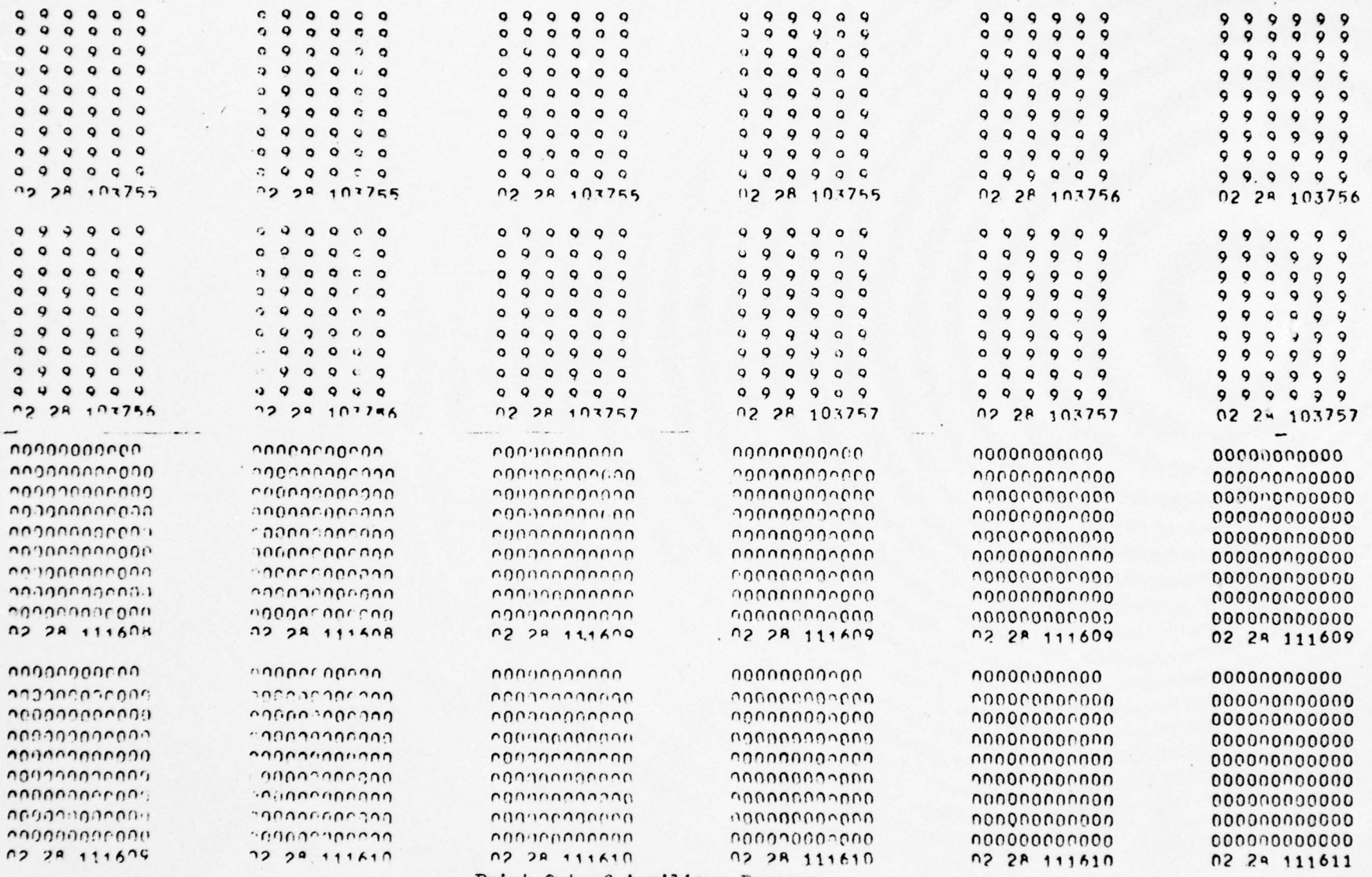
three code and transfer to a 30 computer word table Restack. (To obtain twelve numbers per line, the 6-bit code will occupy two full computer words and 12 bits of the third word in the table Restack. The twelve numbers per line is identical to the "on-line" ADDGS printer format.) A test for overflow is made on incoming BCD data by determining if the number is ten or larger. If overflow exists, the number zero is put in place of the number tested and will be interpreted by printing a space. This is due to the data allocation or format from the ADDGS.

Preprint Routine

The function of the preprint routine is to rearrange the data in Restack to a format acceptable to the CS-1 Print Buff Routine.

Tape Write Routine

The function of the tape write routine (TWR) is to maintain the input of data from the CCPS and output of data to computer magnetic tape between INBUFF and INBUFF B. This routine is called from the Executive Routine whenever either buffer is filled. It will test to see which buffer made the call, start the input of data on the other buffer, write out the data on magnetic tape, and then clear the buffer that made the call. When key 2 is set, this routine, when called, will always jump to its exit. When key 3 is set, it will write and end-file onto magnetic tape.



Print Out of Auxiliary Program

Figure 5

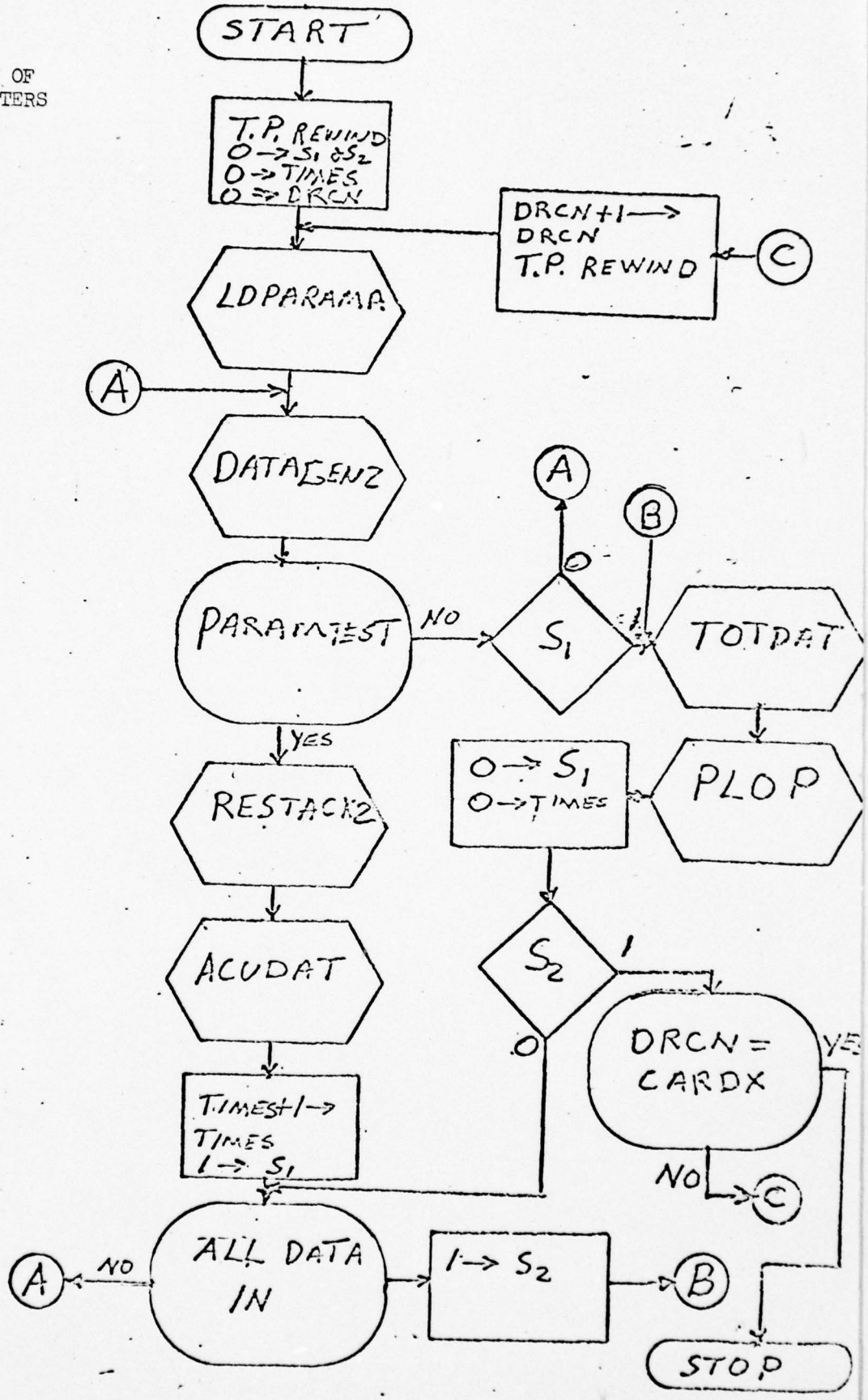


Figure 6

CRA
6-21-67

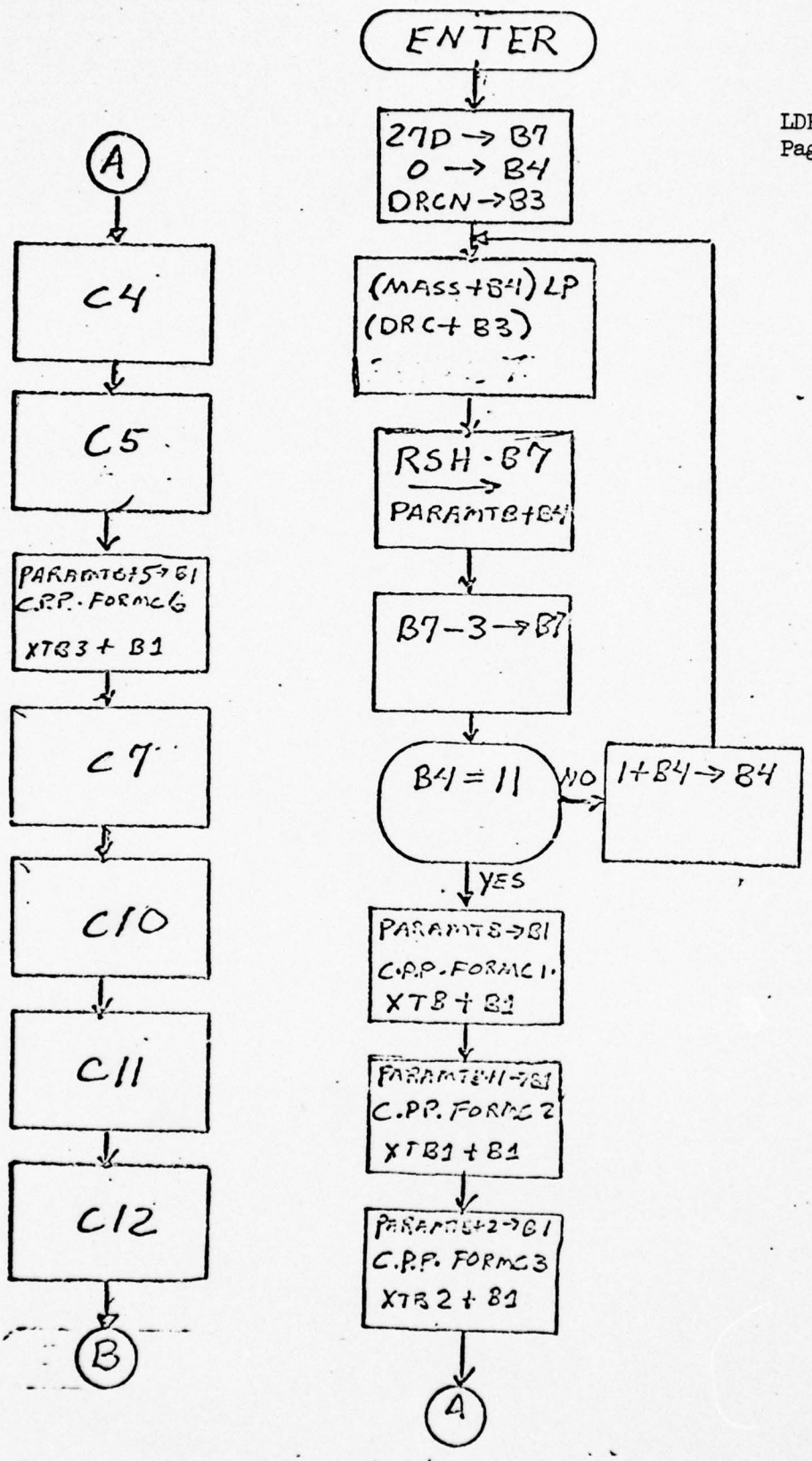

ENTER
27D → B7
0 → B4
DRCN → B3
(MASS+B4) LP
(DRC+B3)
RSH · B7
PARAMTB+B4
B7-3 → B7
B4 = 11
NO
1+B4 → B4
YES
PARAMTB → B1
C.P.P. FORMC1
XTB + B1
PARAMTB+1 → B1
C.P.P. FORMC2
XTB1 + B1
PARAMTB+2 → B1
C.P.P. FORMC3
XTB2 + B1
4
A
C4
C5
PARAMTB+5 → B1
C.P.P. FORMC6
XTB3 + B1
C7
C10
C11
C12
B

Figure 7

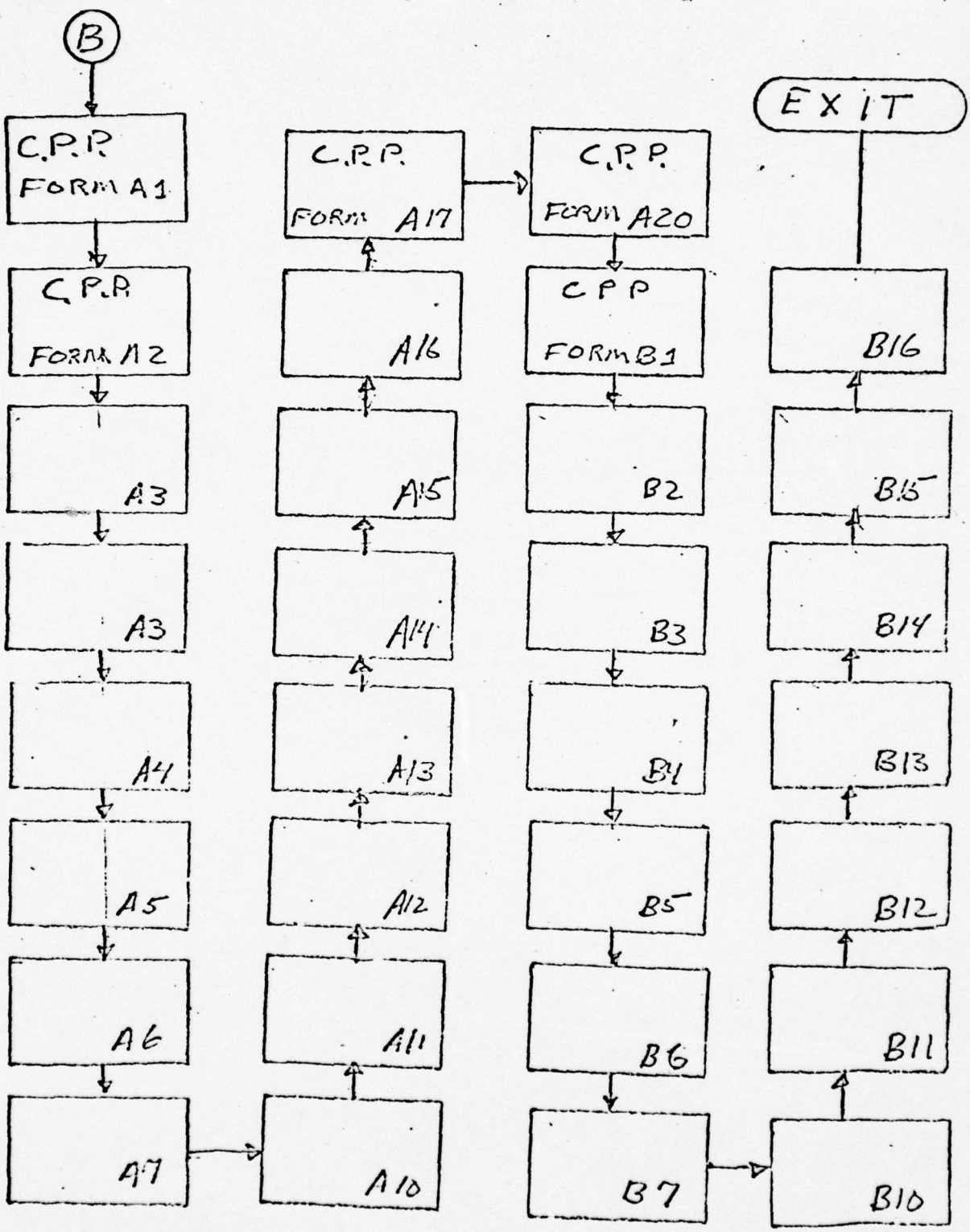


Figure 8

CBA
6-21-87

DATAGEN 2

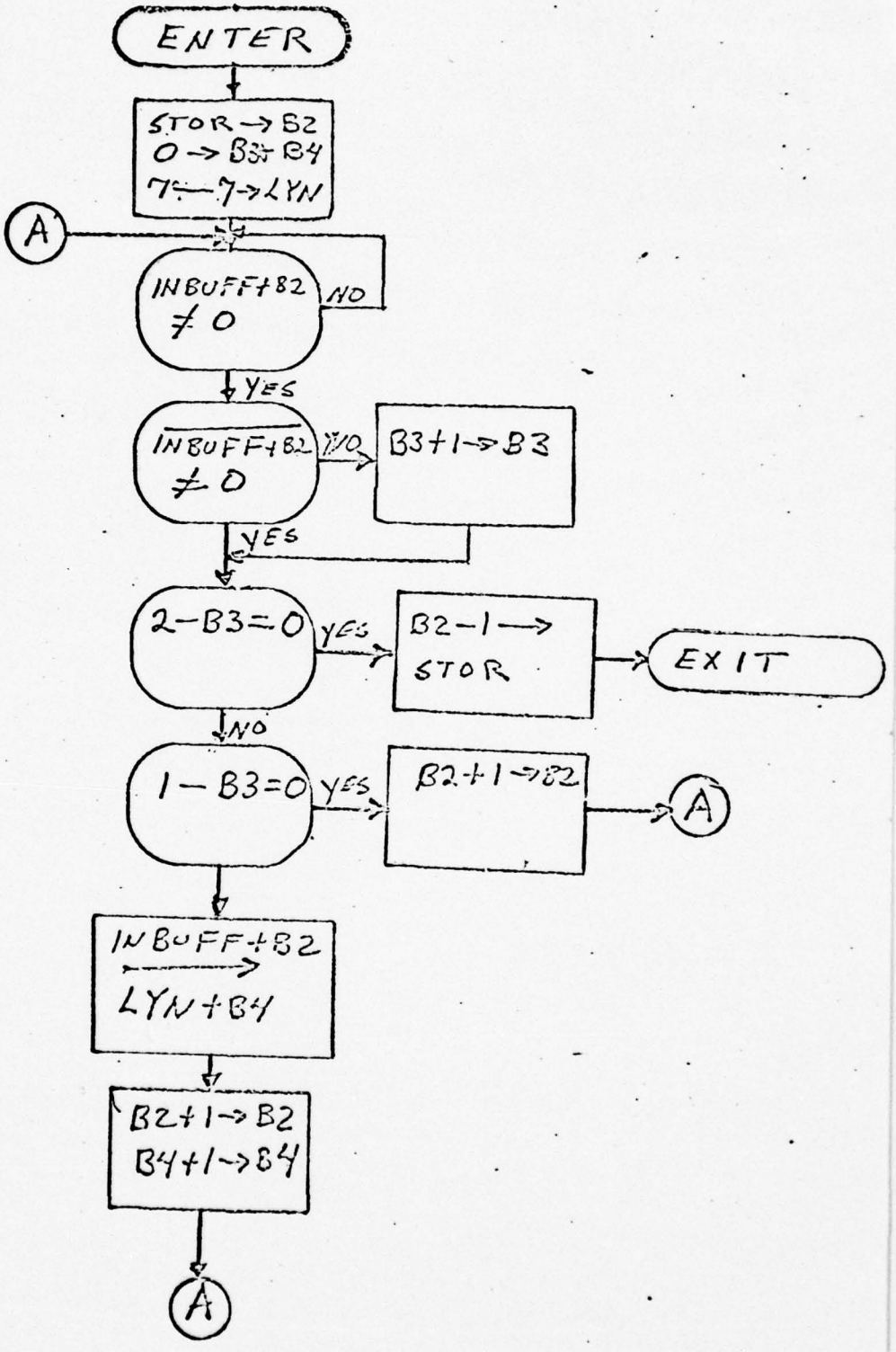


Figure 9

CBN
6-21-77

PARATEST
Page 1 of 2

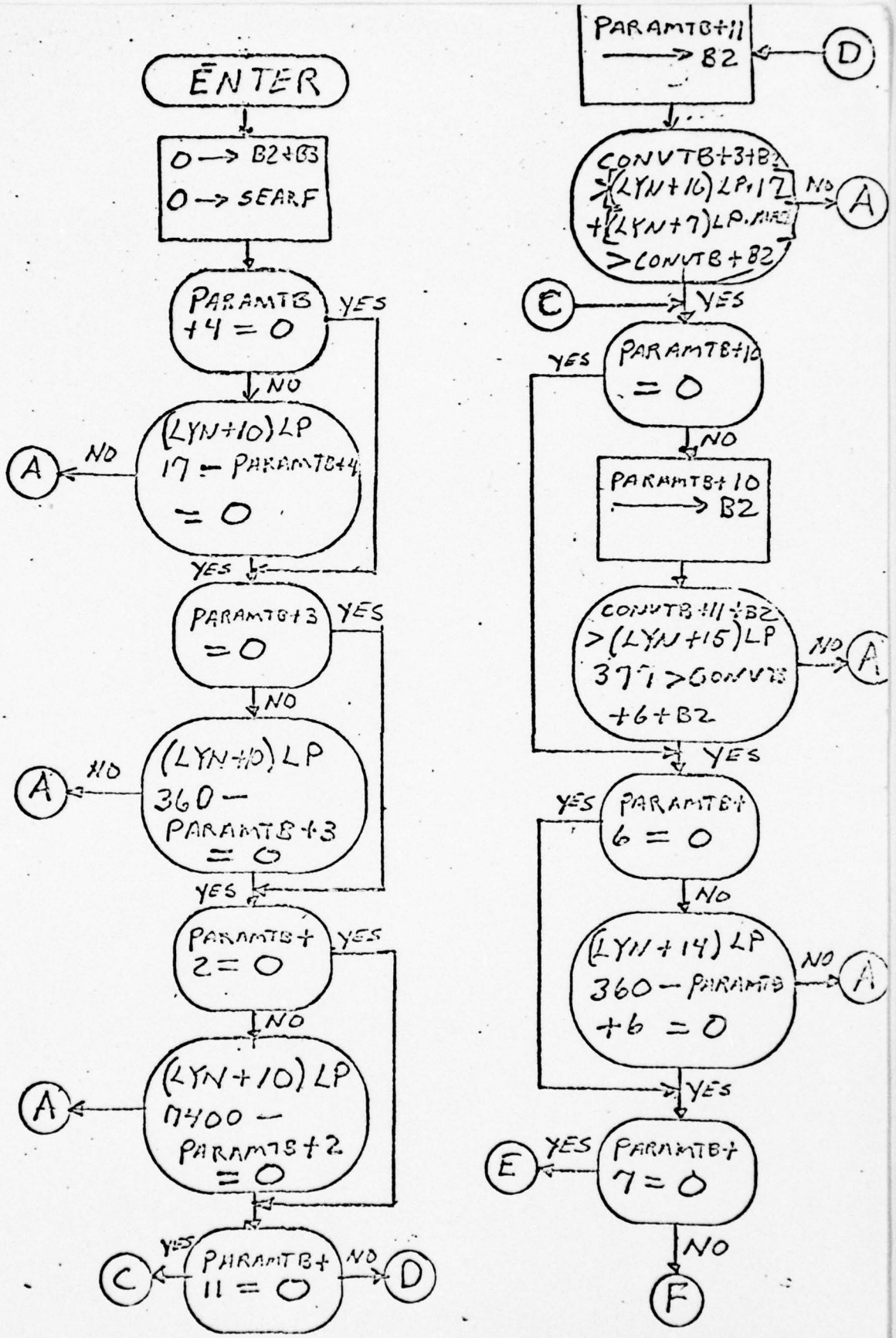


Figure 10

CBA
6-21-67

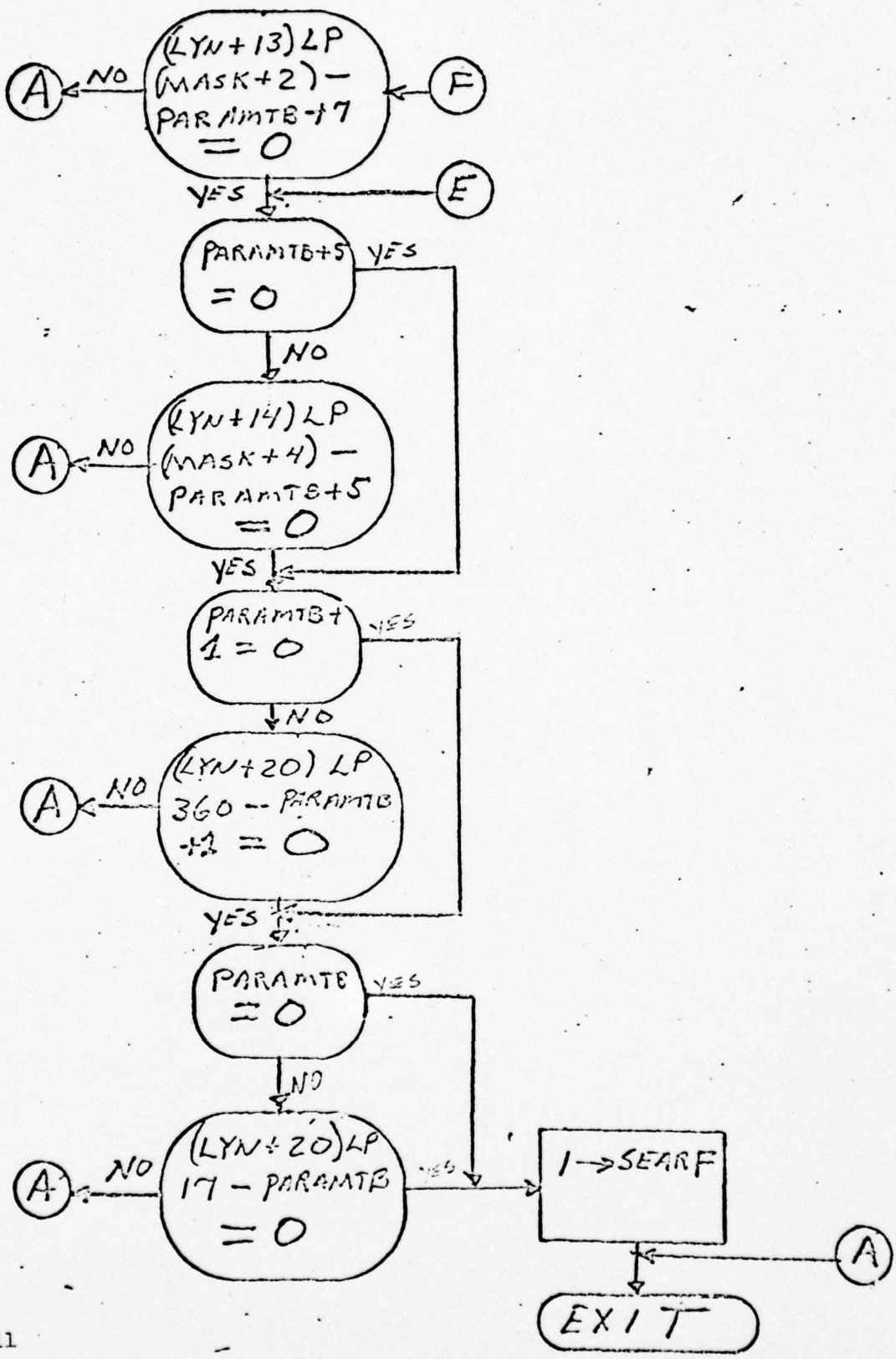


Figure 11

eer
6-21-67

RESTACK 2

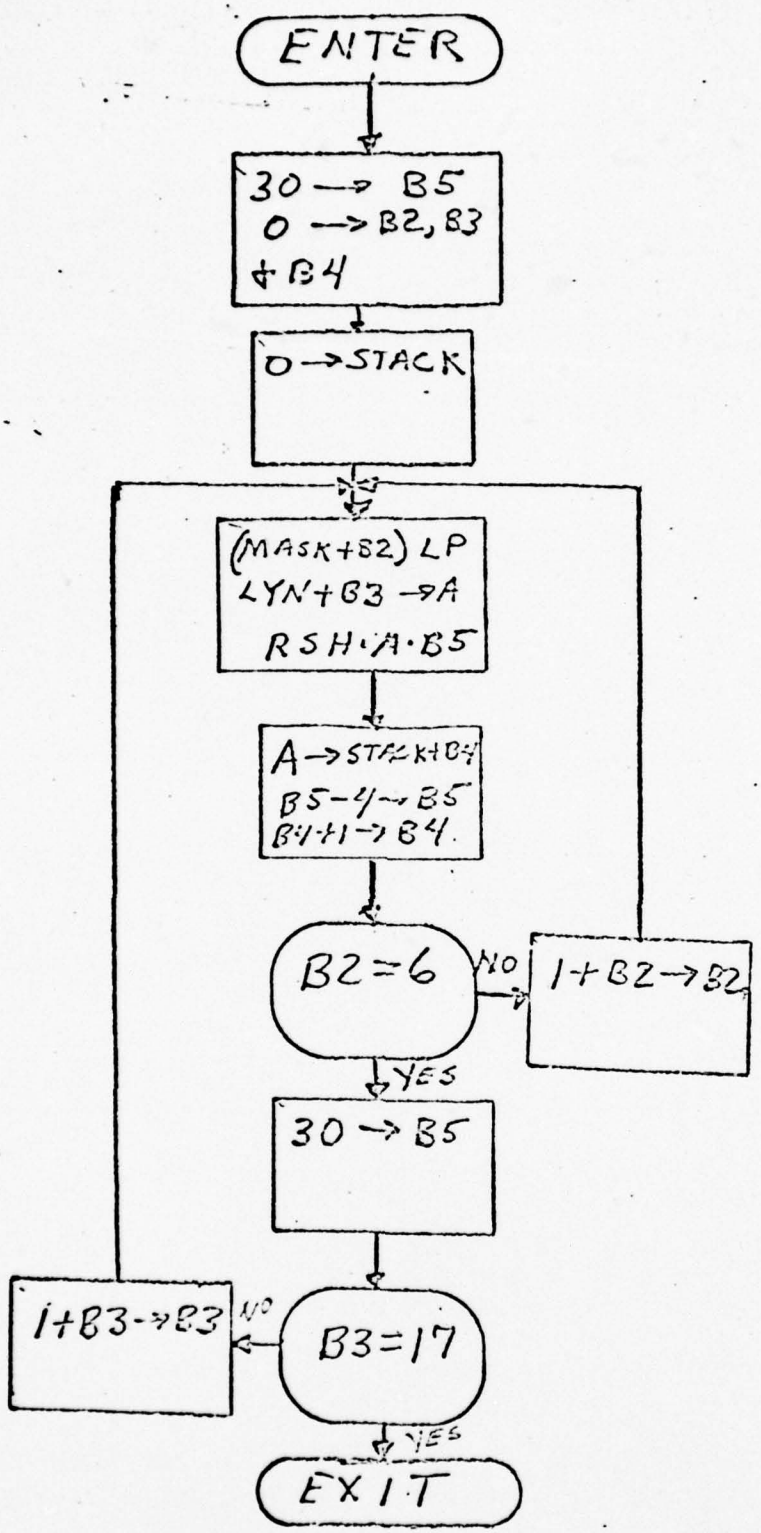


Figure 12

CBA
6-21-77

ACUDAT
Page 1 of 3

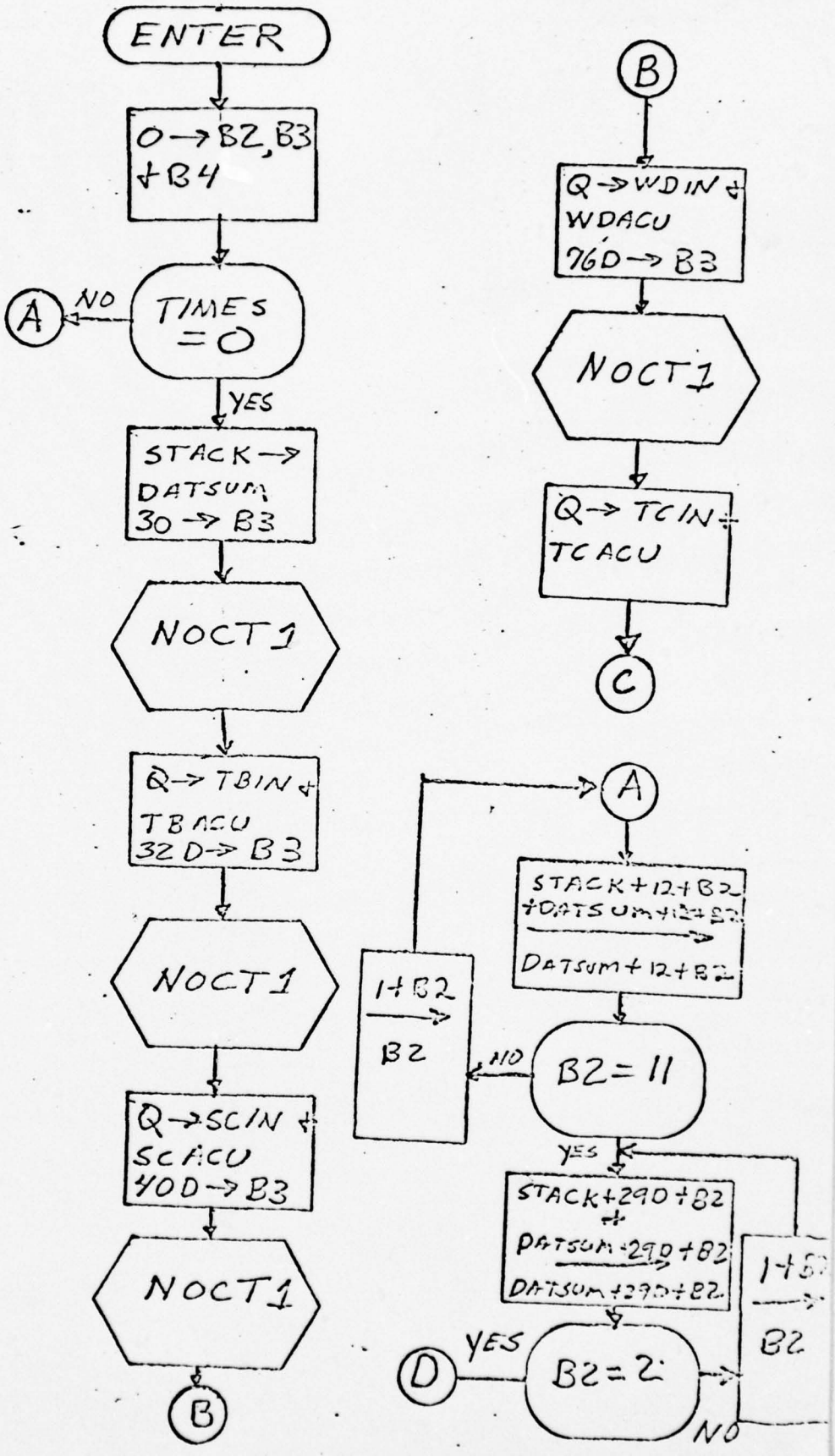


Figure 13
CBN
6-21-67

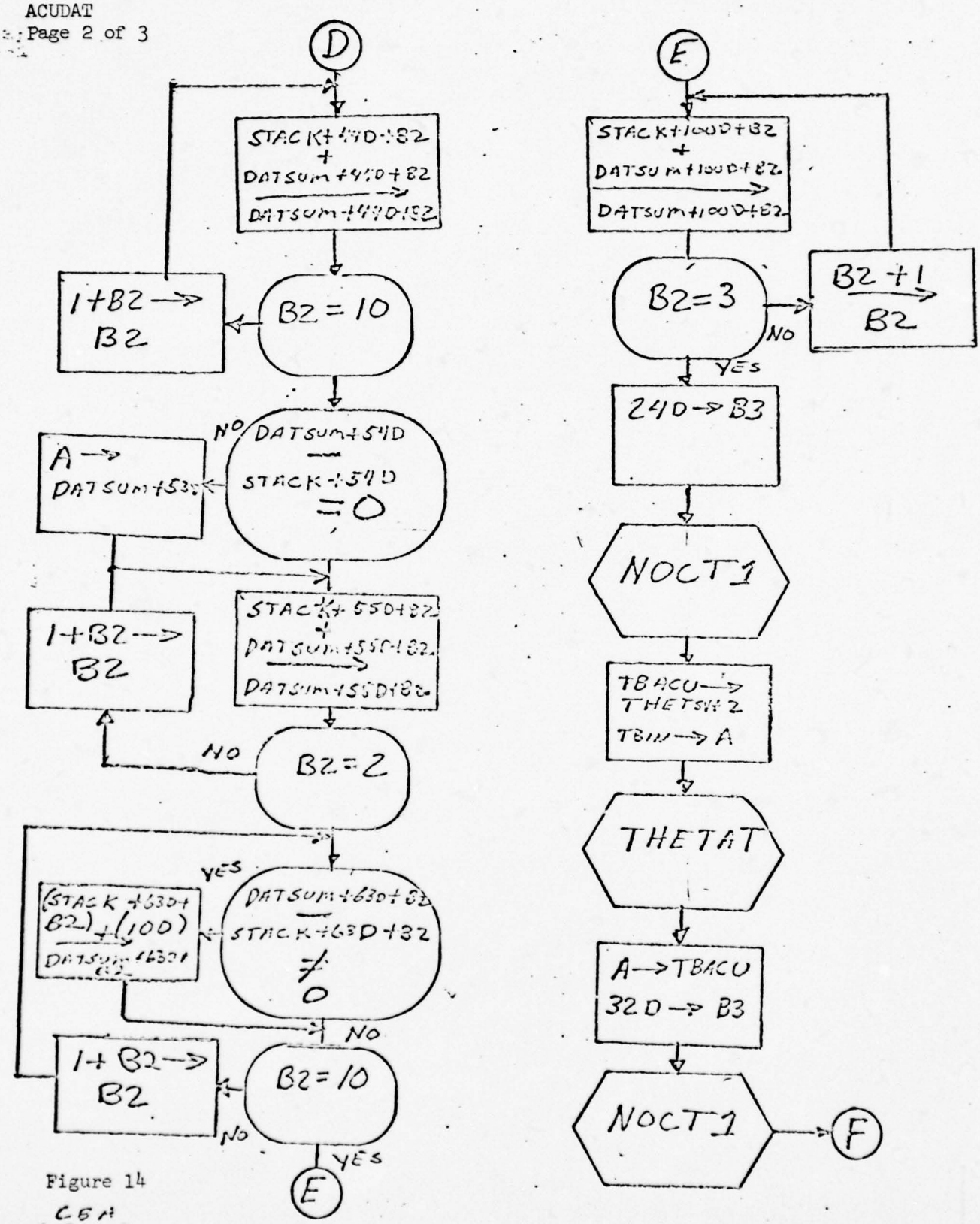


Figure 14

CSA
6-21-69

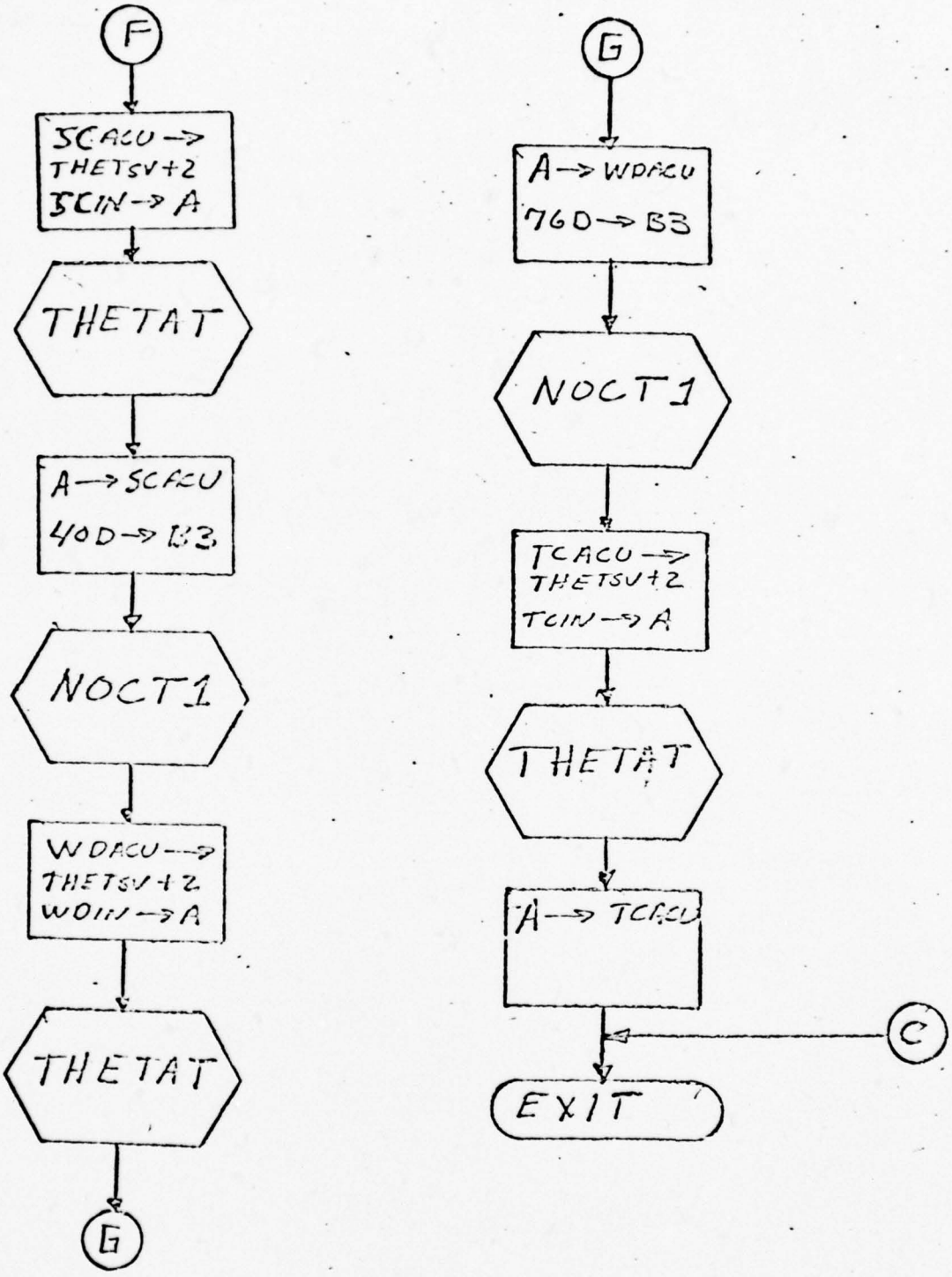

F
SCACU →
THETSV+2
SCIN → A
THETAT
A → SCACU
40D → B3
NOCT1
WDACU →
THETSV+2
WOIN → A
THETAT
G
G
A → WDACU
760 → B3
NOCT1
TCACU →
THETSV+2
TCIN → A
THETAT
A → TCACU
C
EXIT

Figure 15

TOIDAT
Page 1 of 5

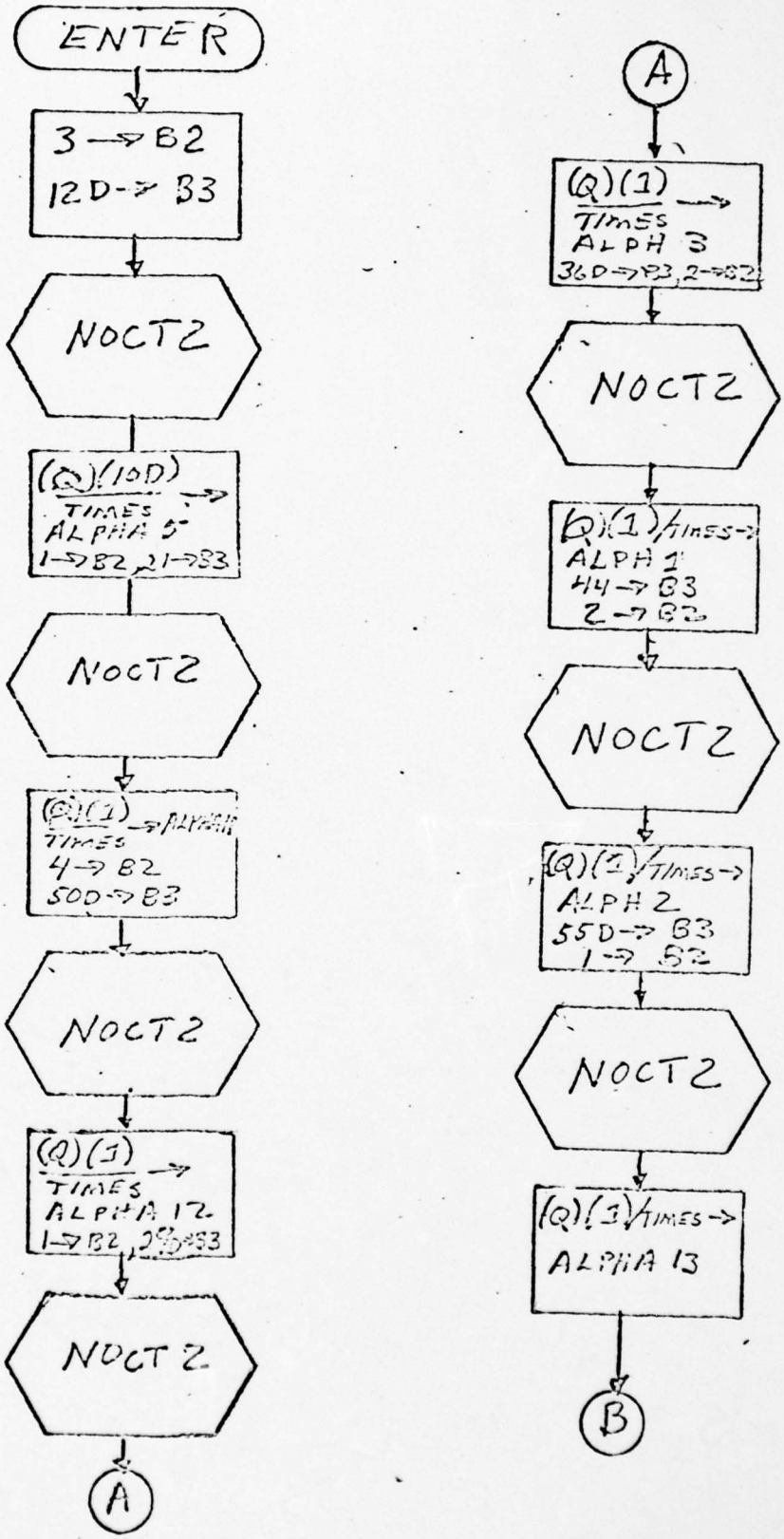


Figure 16

C BA
0-2 1-11

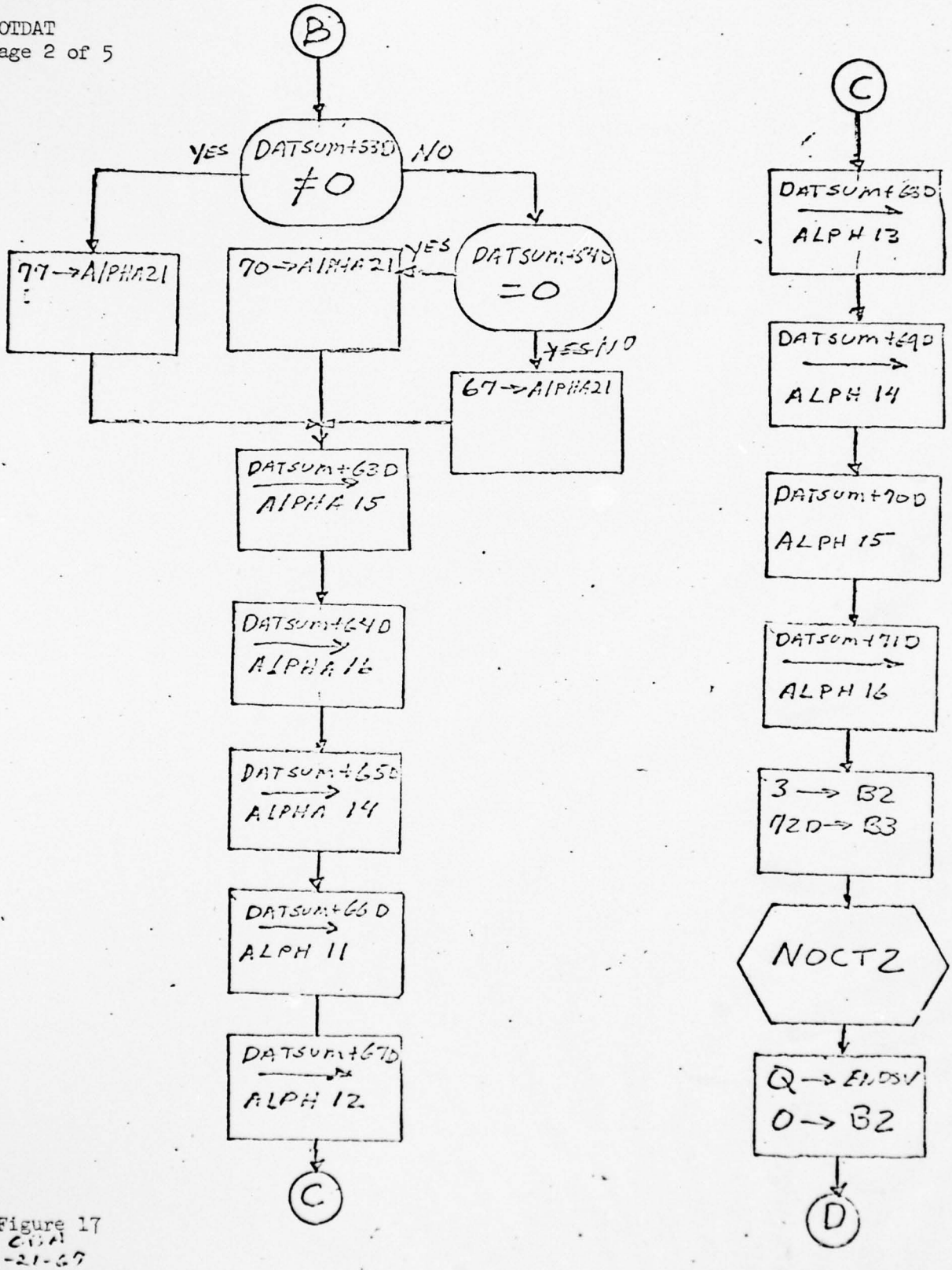


Figure 17
CWA
6-21-67

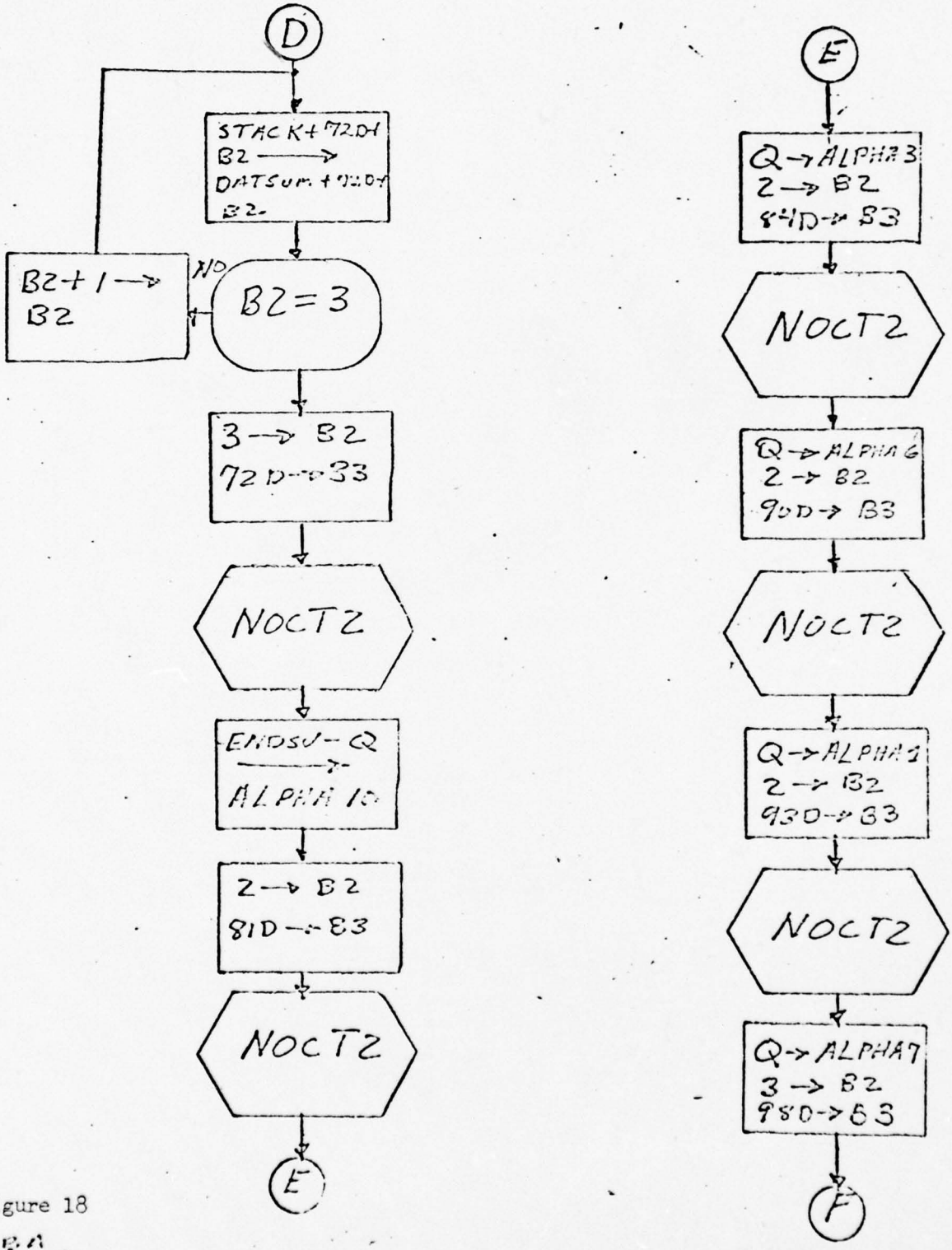


Figure 18

CBA
6-21-67

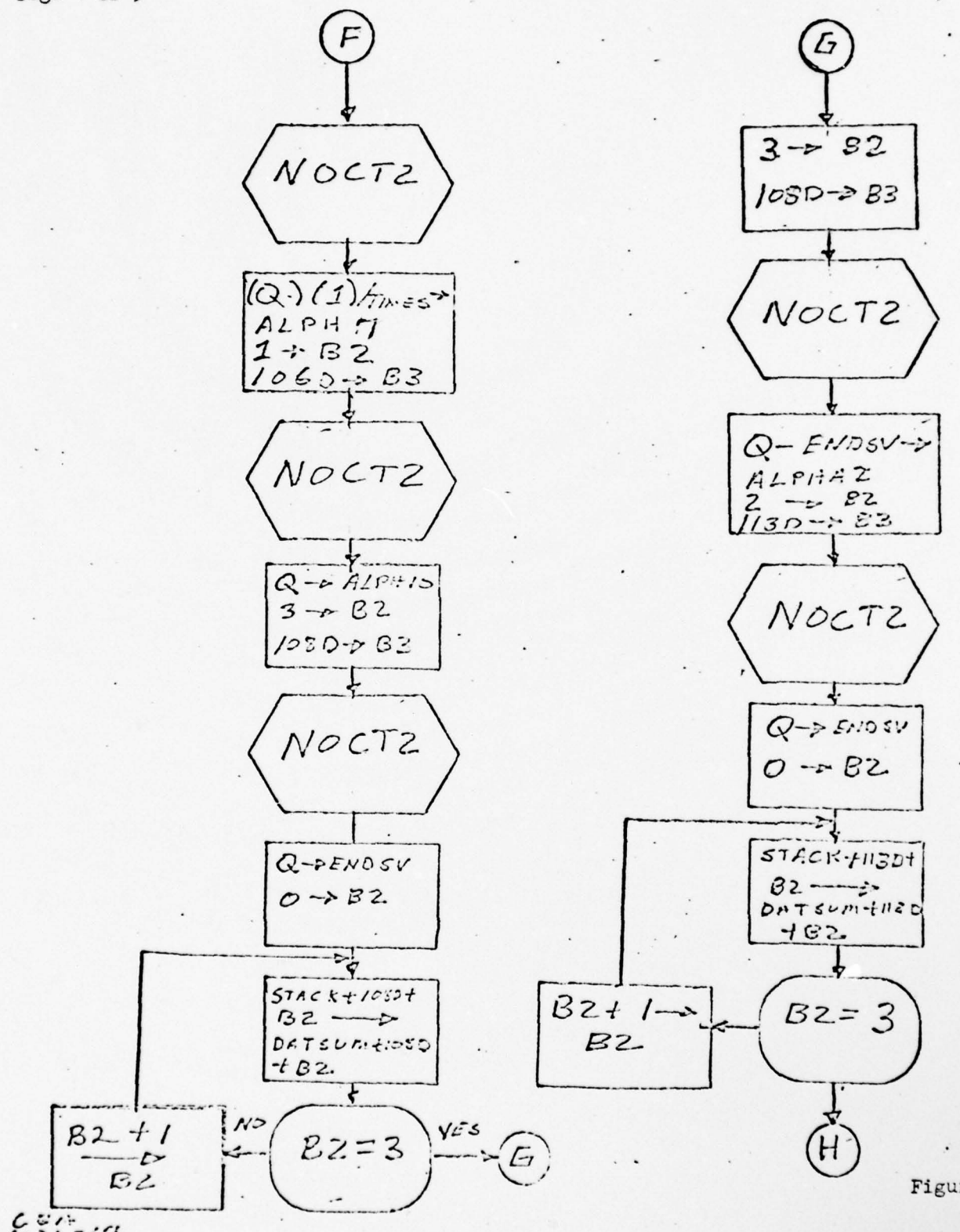

F
NOCT2
(Q-)(1) TIMES→ ALPH 7
1 → B2
1060 → B3
NOCT2
Q → ALPH 5
3 → B2
105D → B2
NOCT2
Q → END SV
0 → B2
STACK + 105D + B2 → DAT SUM + 105D + B2
B2 + 1 → B2
NO
B2 = 3
YES
G
G
3 → B2
105D → B3
NOCT2
Q - END SV → ALPHA 2
2 → B2
113D → B3
NOCT2
Q → END SV
0 → B2
STACK + 113D + B2 → DAT SUM + 113D + B2
B2 + 1 → B2
B2 = 3
H

Figure 19

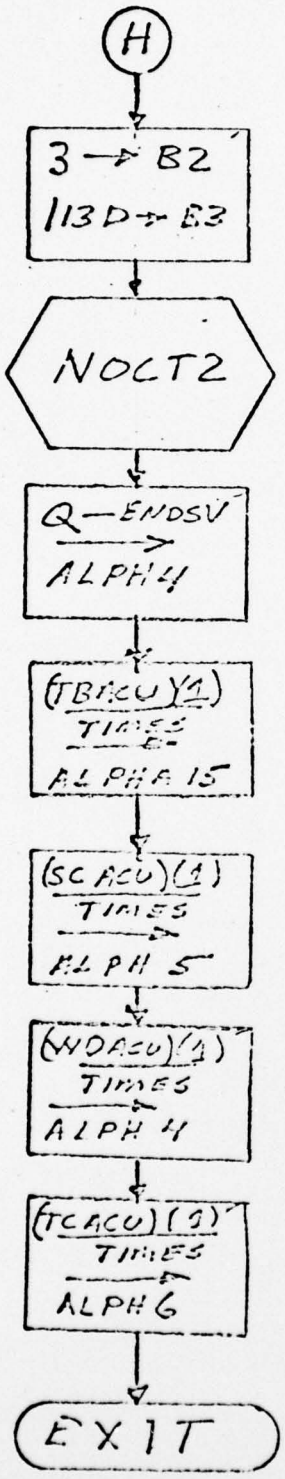


Figure 20

CBA
6-21-84

PLOP
Page 1 of 2

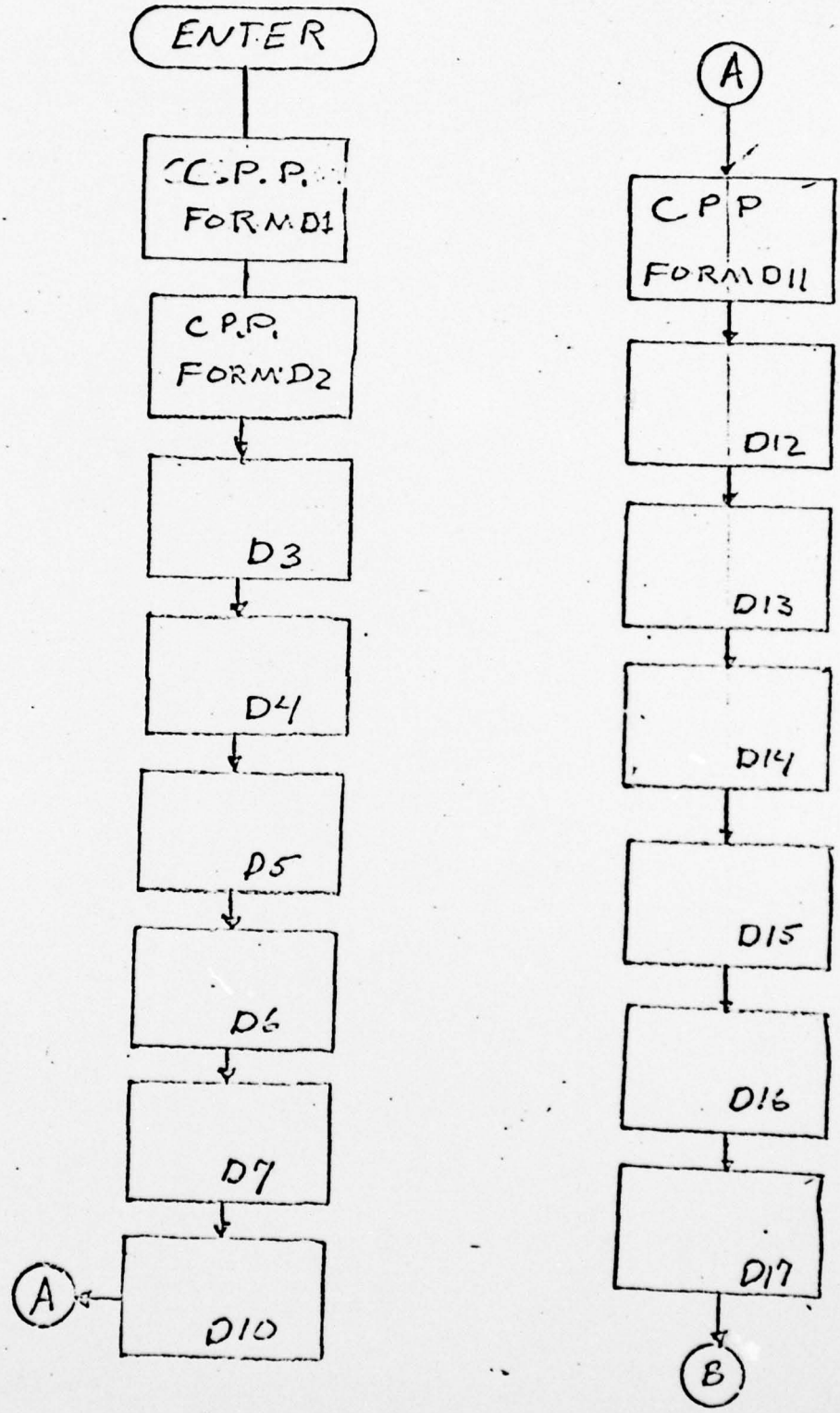


Figure 21

CGA
6-21-77

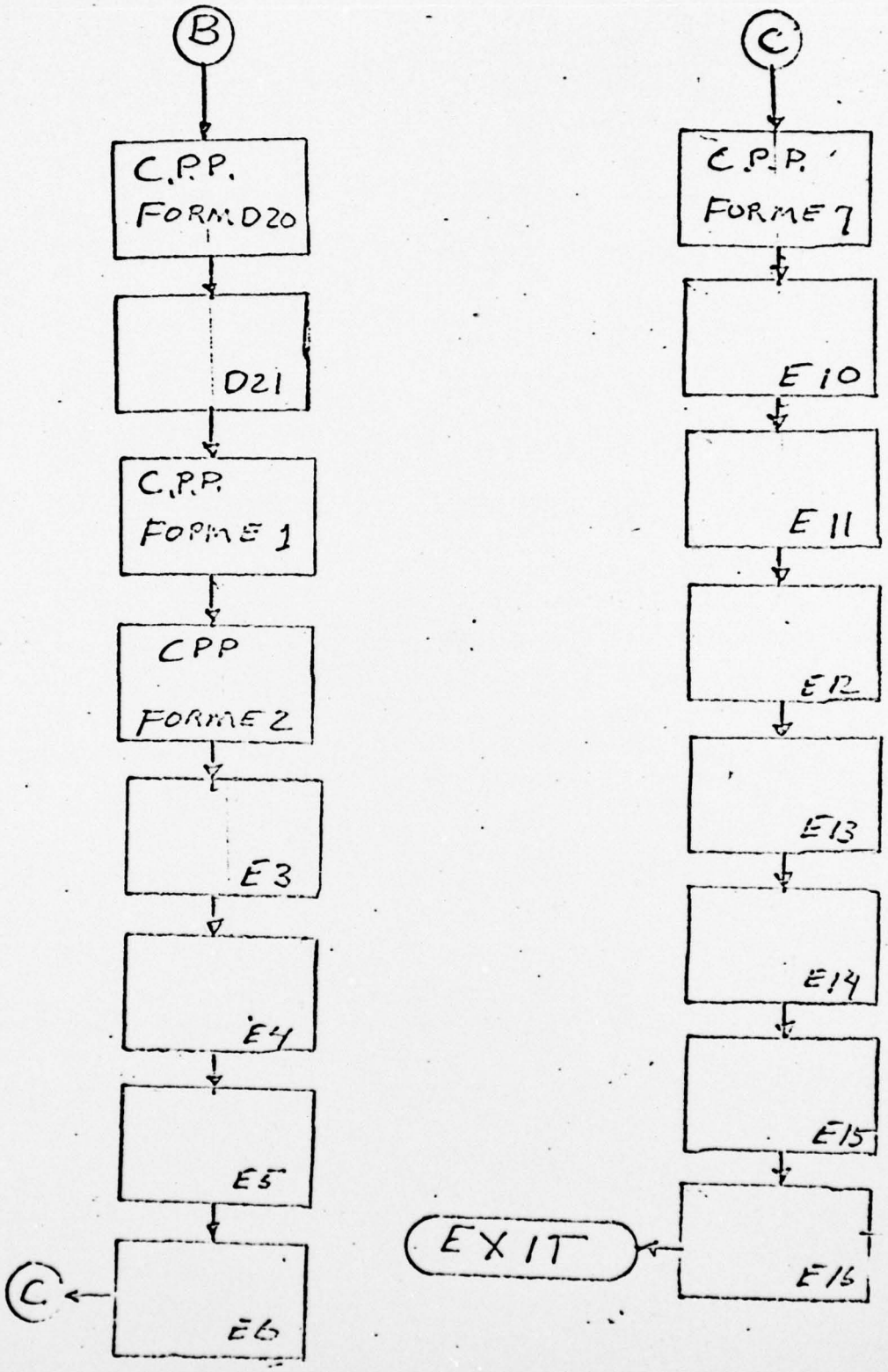


Figure 22

C.B.P.
6-21-67

NOCT 1

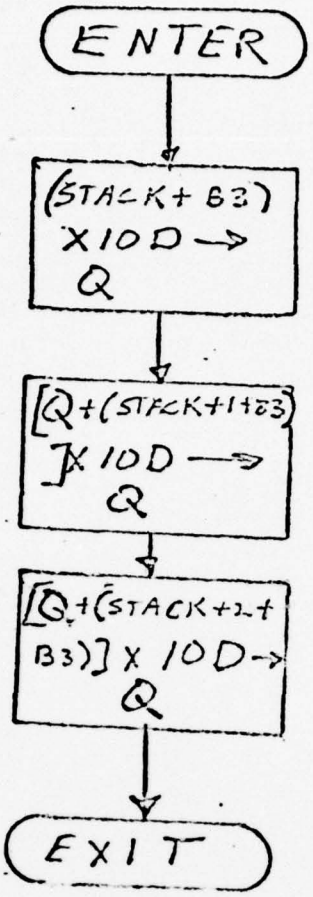


Figure 23*

CBA
6-21-67

NOCT 2

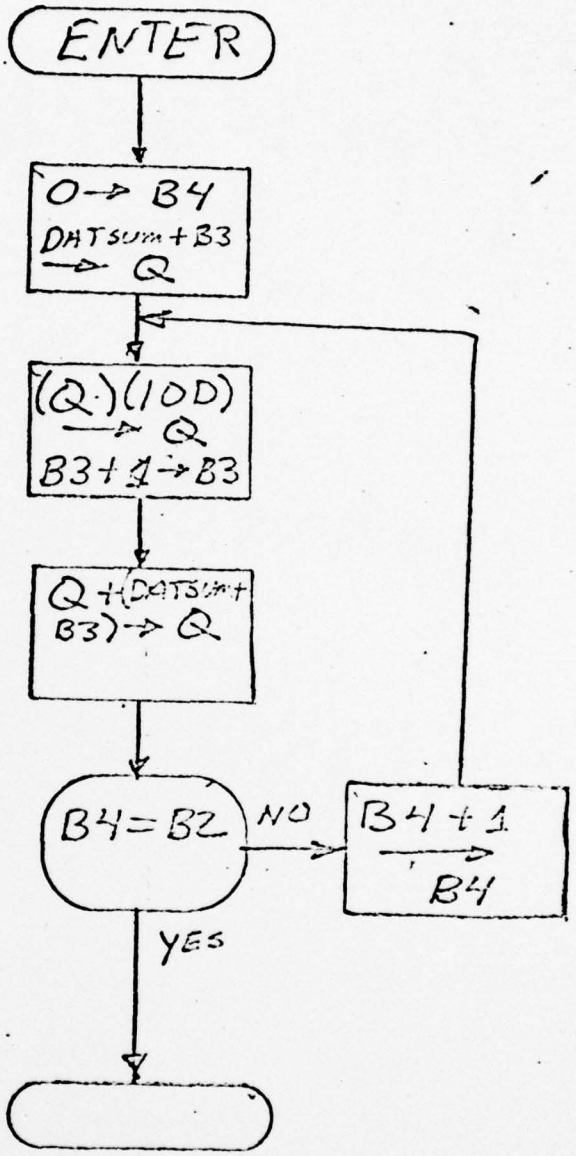


Figure 24

CBA
6-21-67

THETAT

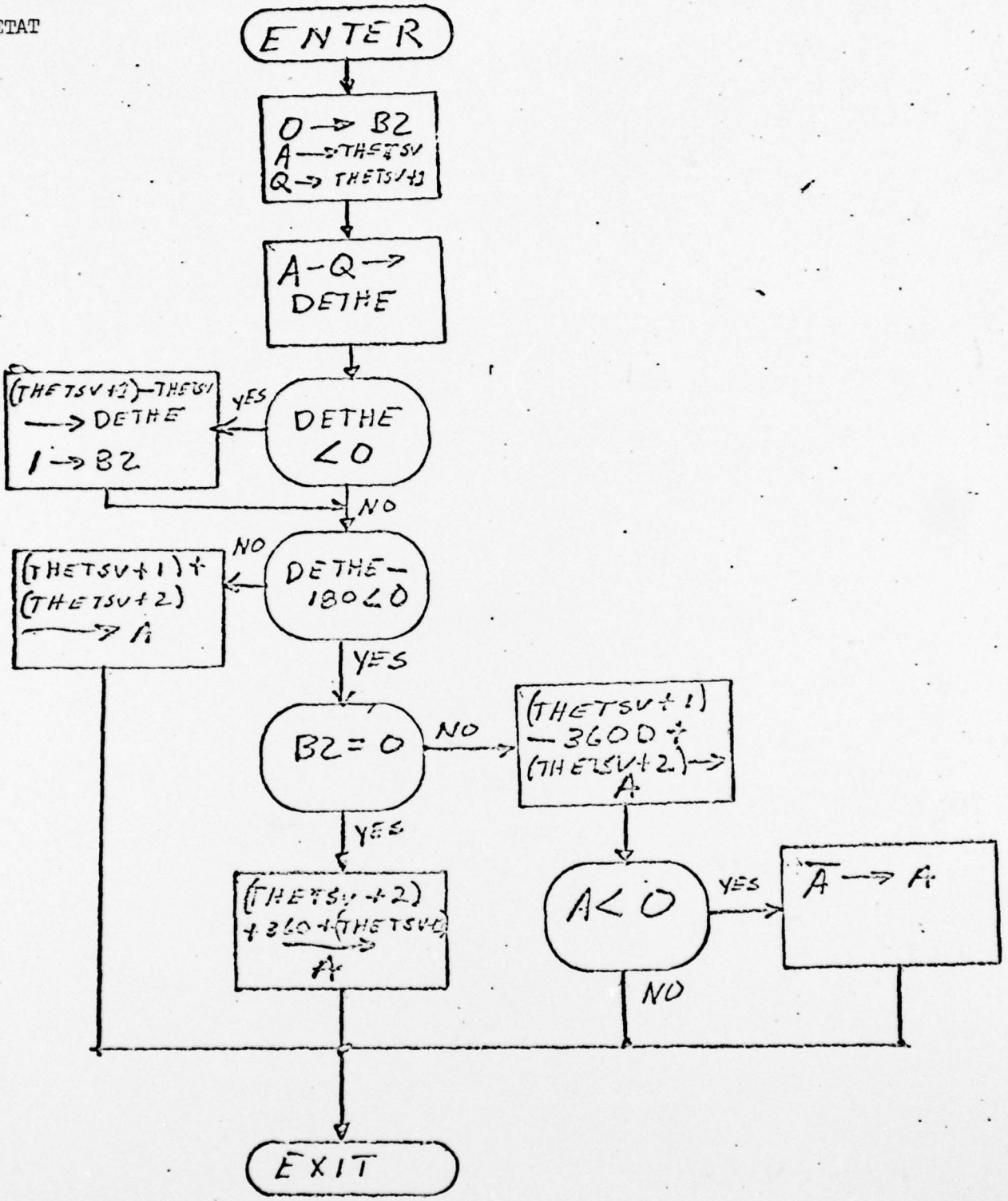


Figure 25

GRA
6-21-77

DATAMAKE

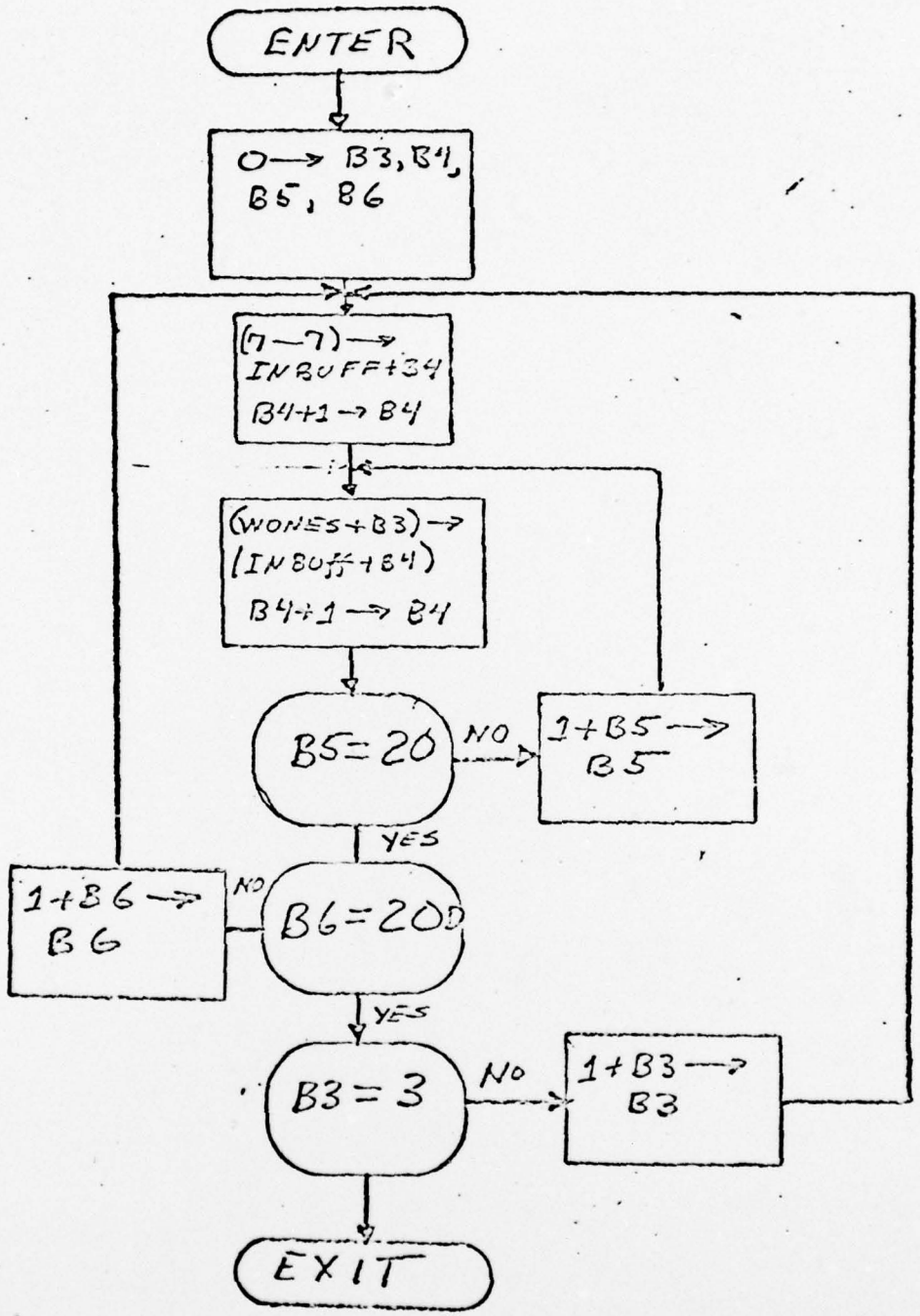


Figure 26

CRA
6-21-67

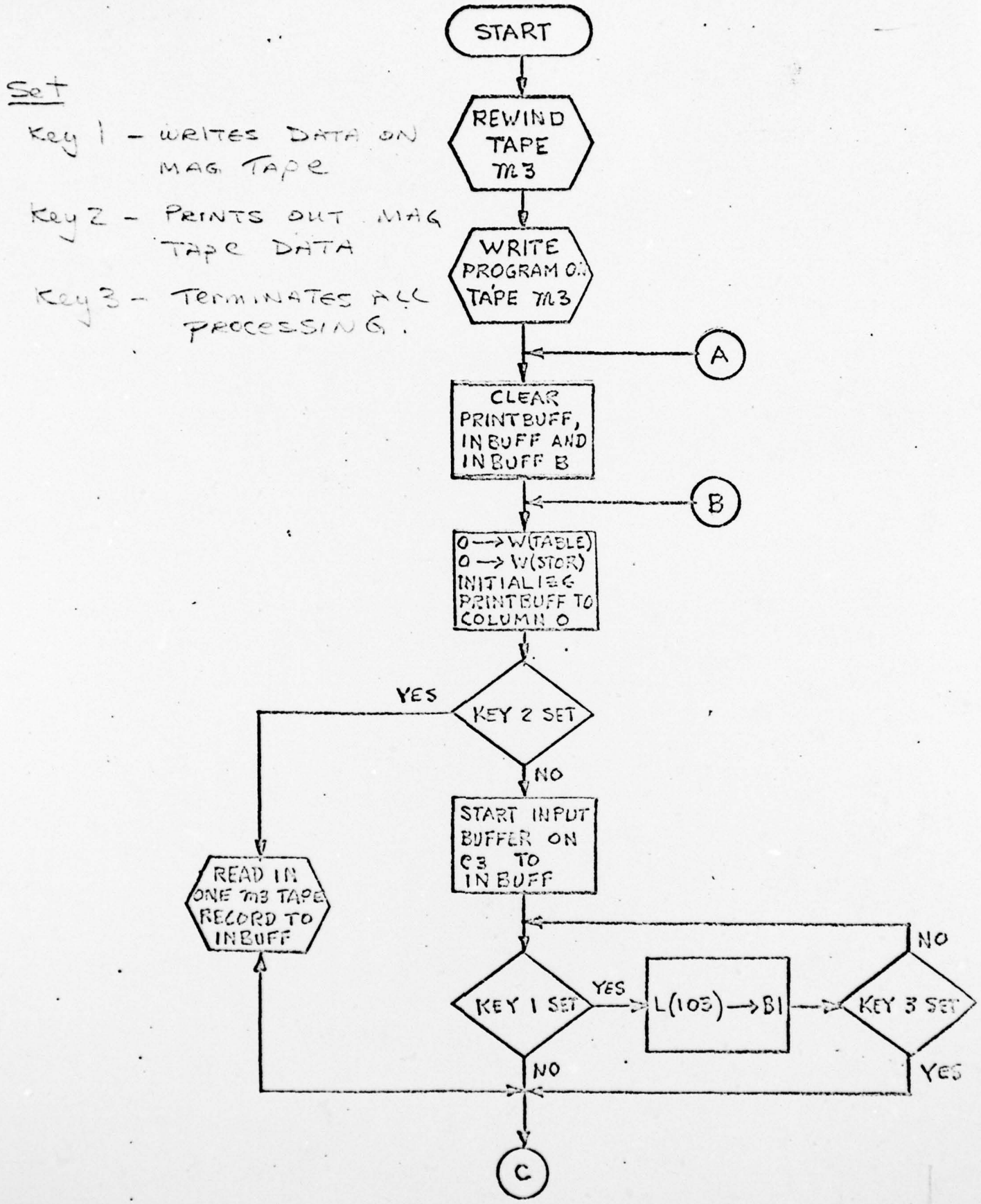
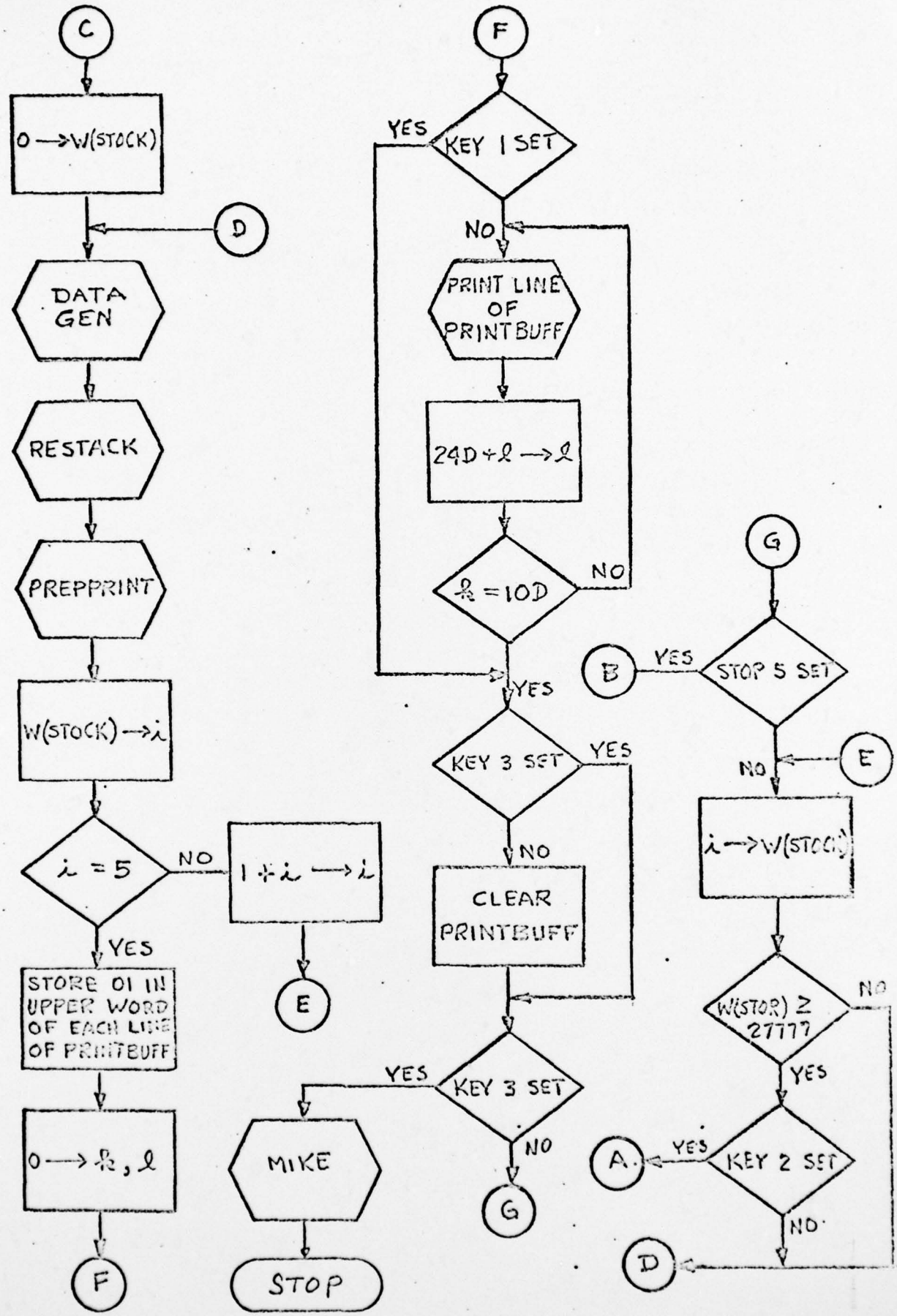


Figure 27

EXEC ROUTINE



EXEC ROUTINE

Figure 28

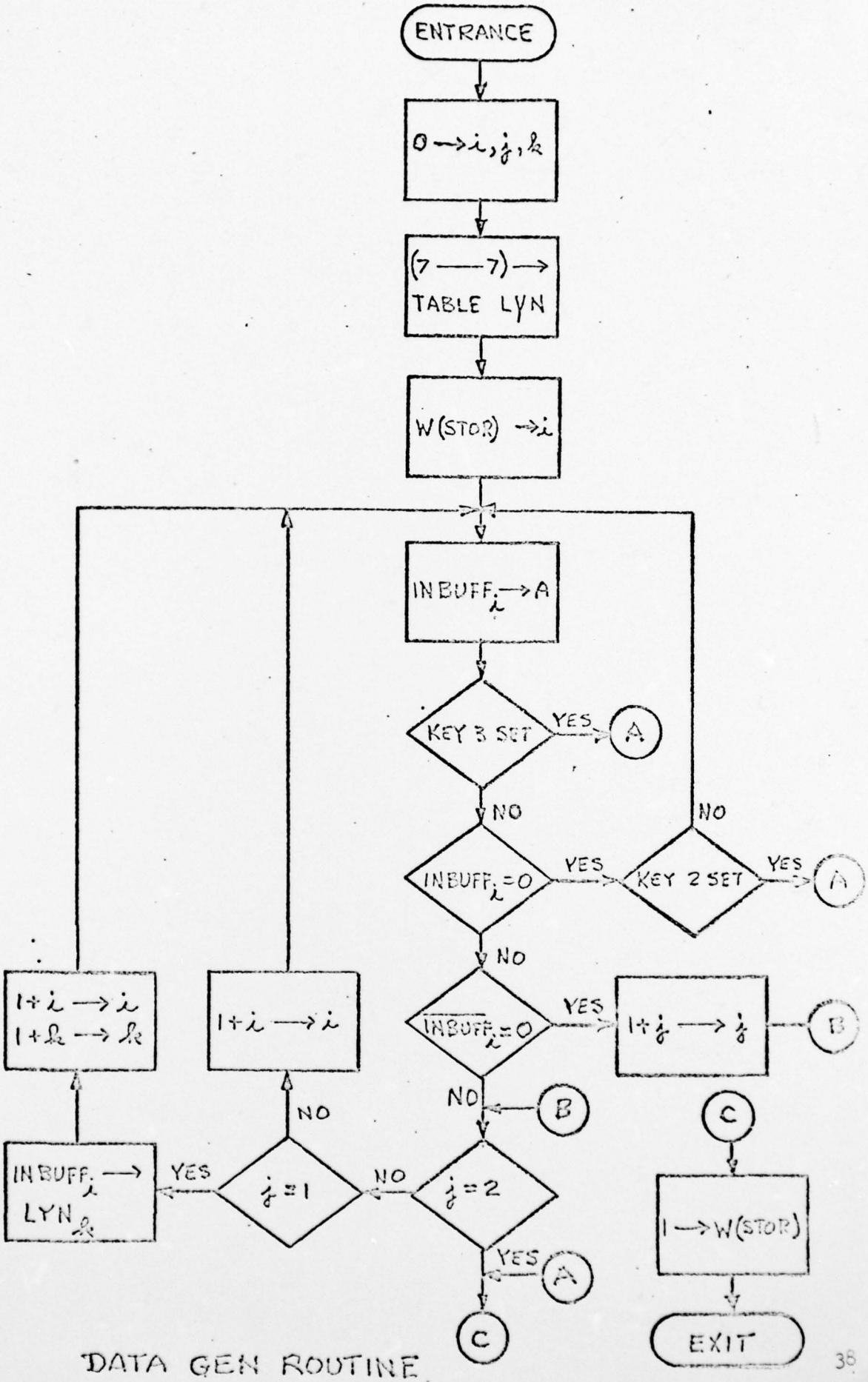
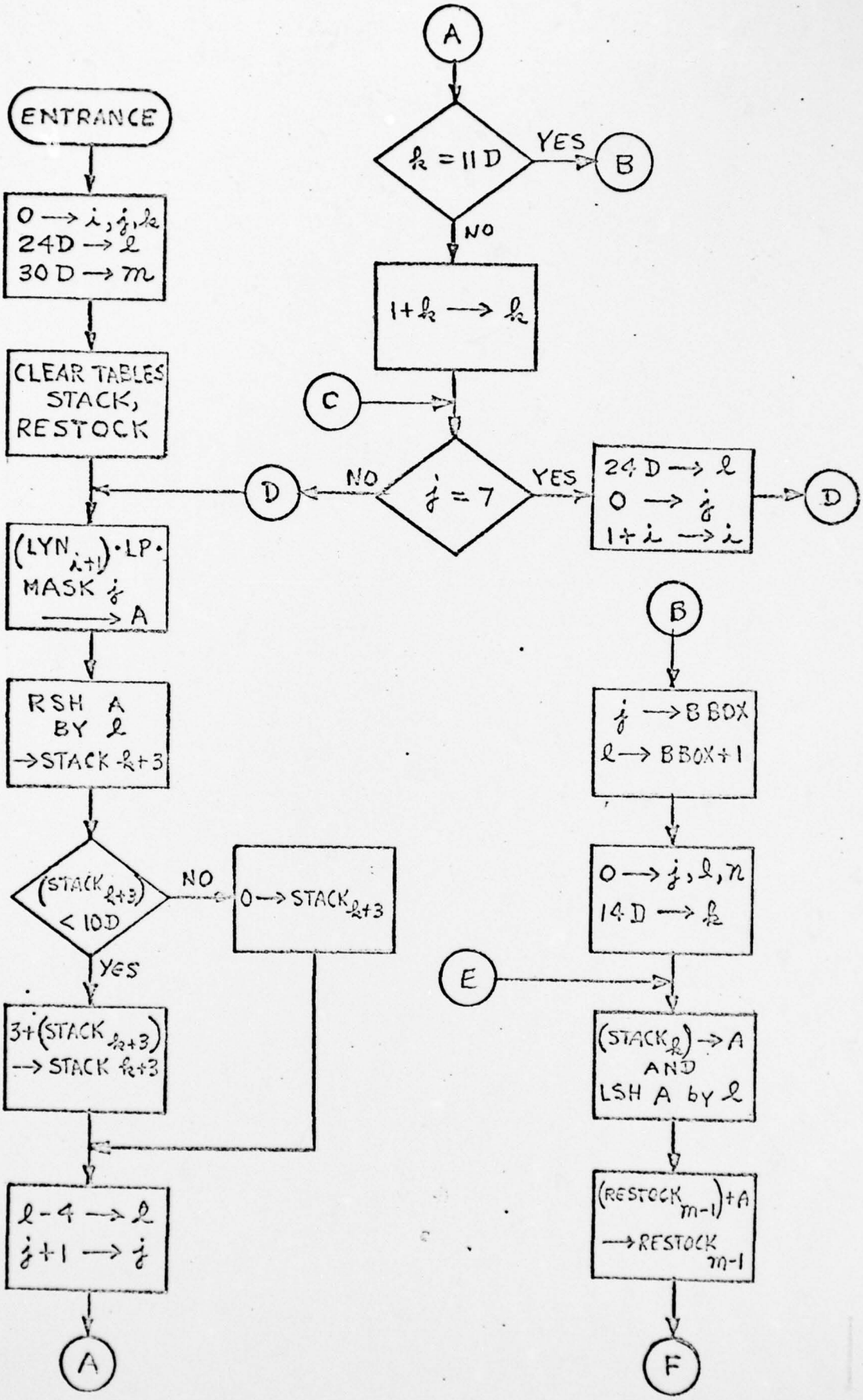


Figure 29

DATA GEN ROUTINE



RESTACK ROUTINE

Figure 30

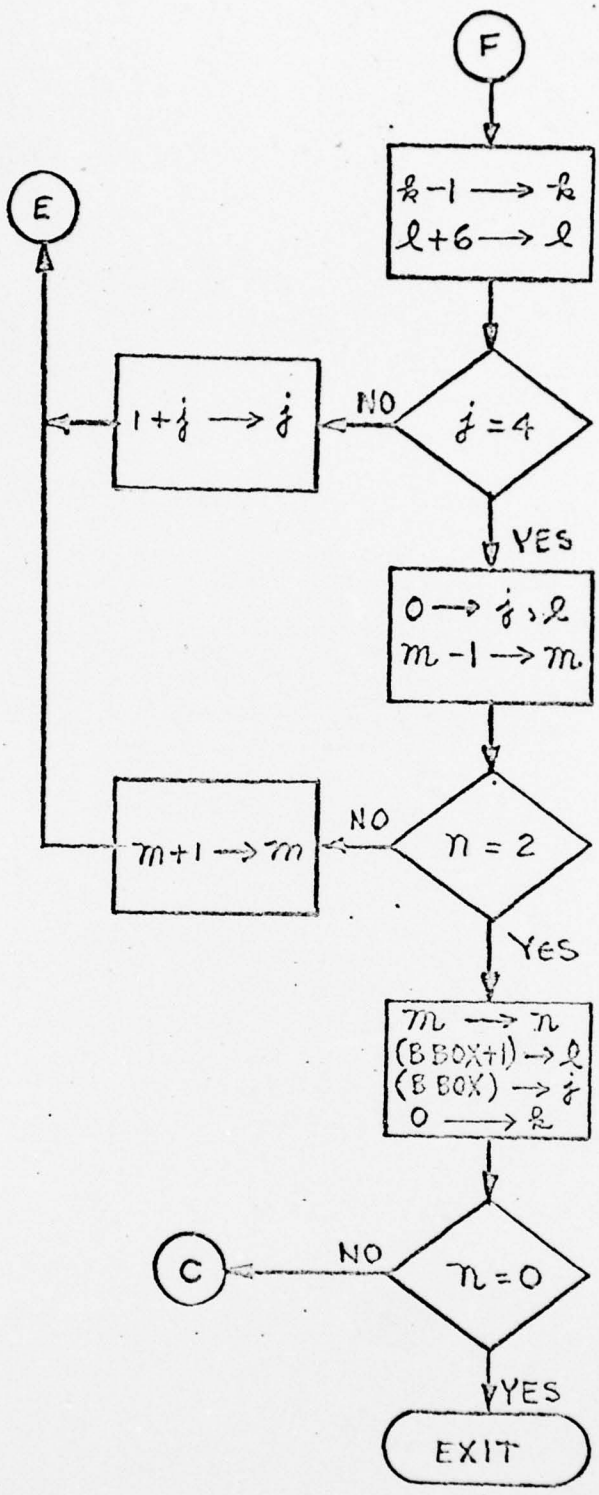


Figure 31

RESTACK ROUTINE

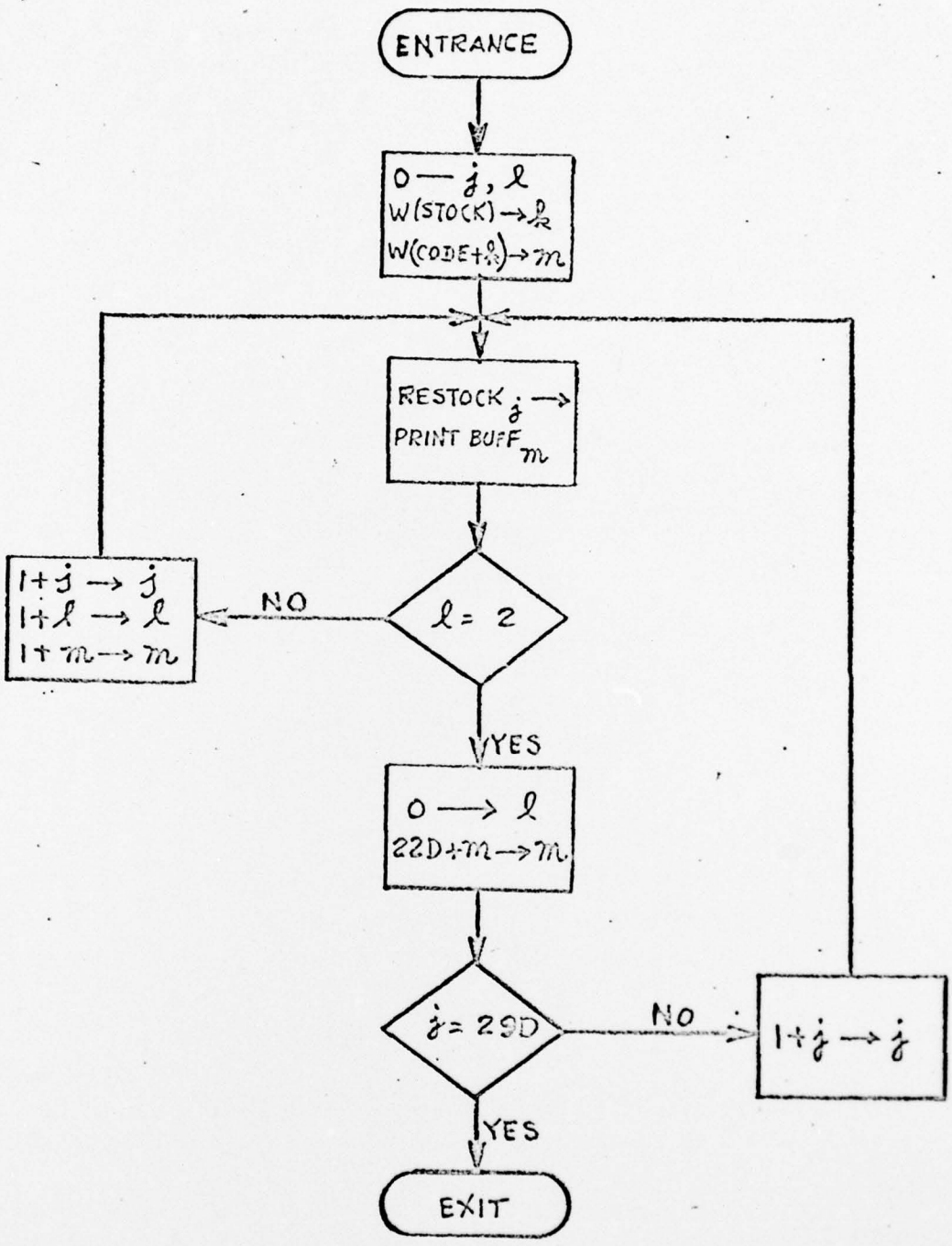


Figure 32 PREPRINT ROUTINE

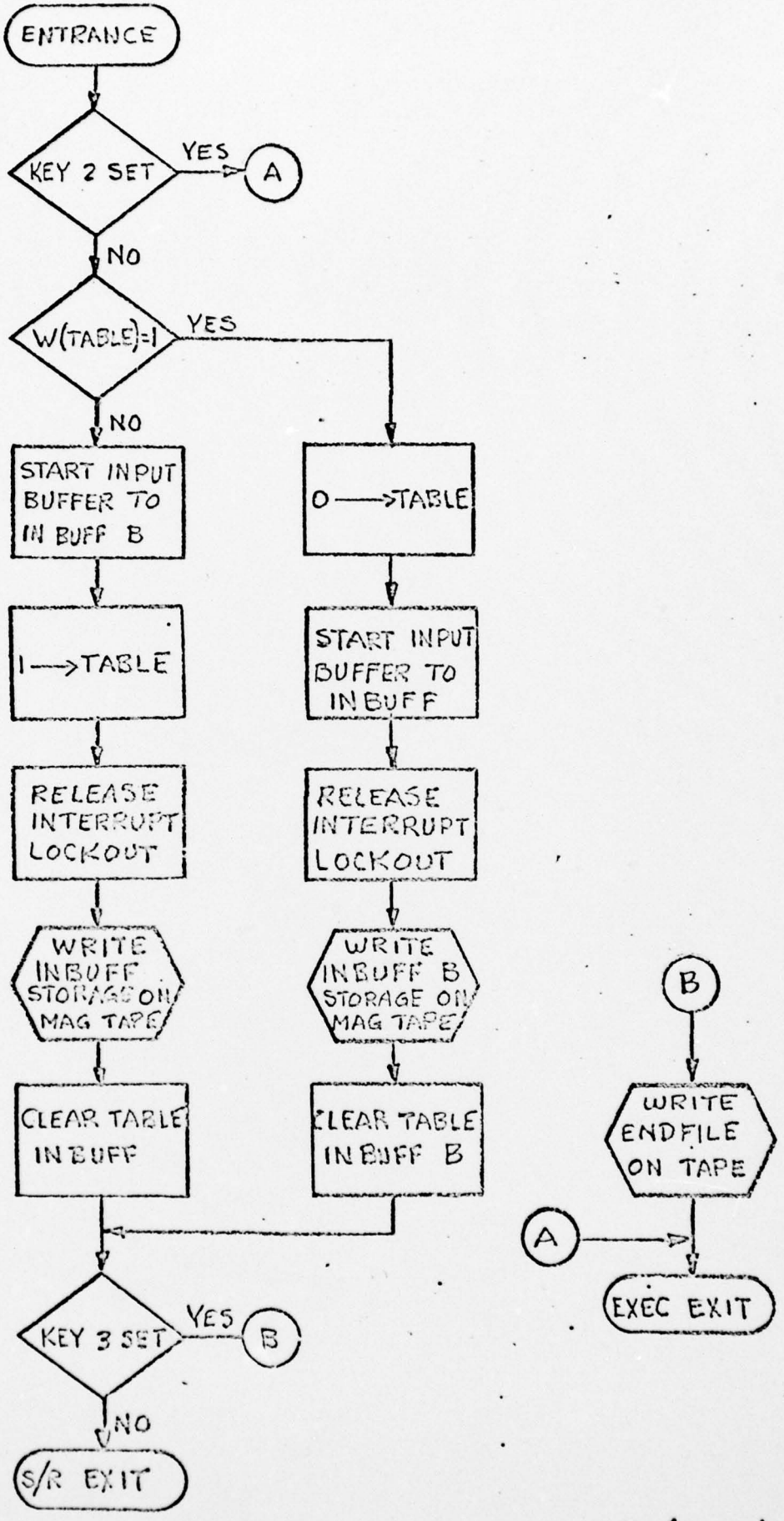


Figure 33

TAPE WRITE ROUTINE (MIKE)